ELECTRICAL REVIEW

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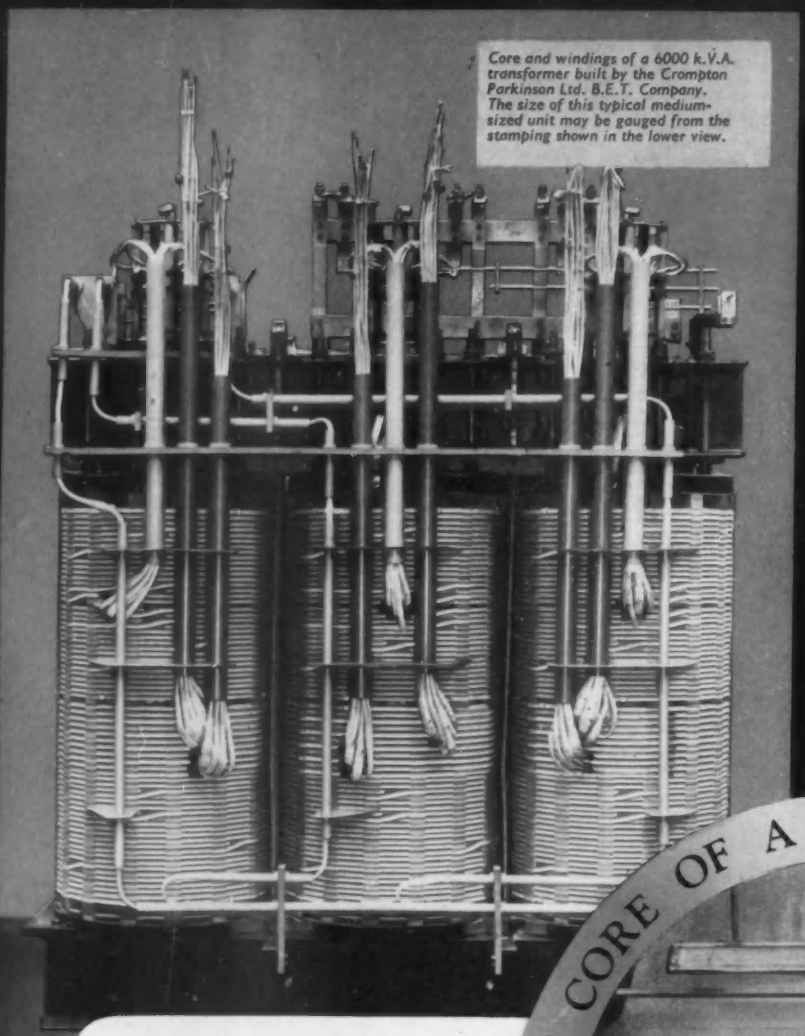
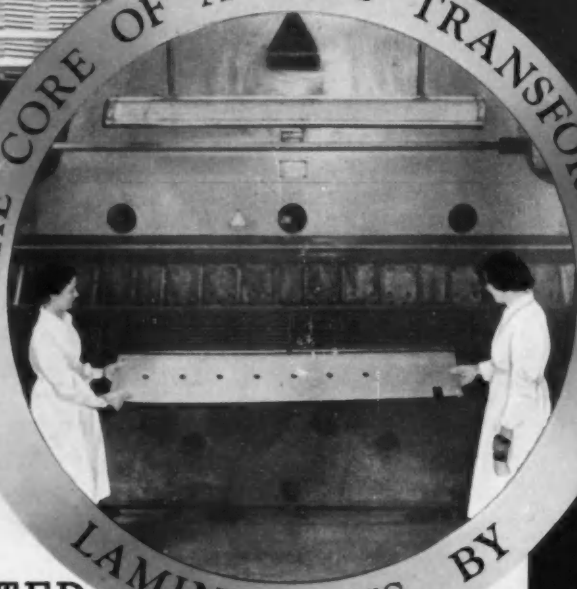


Core and windings of a 6000 k.V.A. transformer built by the Crompton Parkinson Ltd. B.E.T. Company. The size of this typical medium-sized unit may be gauged from the stamping shown in the lower view.

THE CORE OF A FINE TRANSFORMER



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ELECTRICAL REVIEW

16 January 1959 Vol. 164 No. 3 Established 1872

Public Enlightenment

IN these days of all-in tariffs it is not easy to assess with great accuracy the proportion of electricity consumed for lighting. What is believed to be a fairly close approximation has been arrived at by the British Lighting Council which puts the figure at about 16 per cent for 1957-58, that is something like 12,000 million kWh. This is a measure of the size of the lighting load but not its importance, which is much greater than the figure implies. Light has always been the thin end of the wedge for further electrical uses and it remains the most widespread application.

Because of this, electric lighting is now taken for granted and, apart from the installation of fancy fittings, most people give the subject no proper thought. This explains the preponderance of inadequate and bad lighting, particularly in homes. But things are not so bad as they were when the Lighting Service Bureau started its activities about thirty-five years ago. There can be no doubt that these activities had an enormous influence upon industrial and commercial lighting installations, as anybody with recollections of the illumination of twenty years ago will realise. Nevertheless there are still many thousands of installations which fall below the now-accepted standards; and the standards themselves are constantly raised. For example, it is reckoned that half a million shops are inadequately lighted. This means that there is plenty to do in the lighting field and no retrogression in business should be experienced by those genuinely engaged in it.

Education in lighting is essential to ensure progress on the right lines: education not only of the architect, the builder and the user but of the electrical industry's own people—particularly the contractors who can exercise much influence in the choice of installations. This is why we are glad that when the Electric Lamp Manufacturers' Association ceased to exist continuity of its educational work was ensured by the formation of the British Lighting Council, a body which embraces not only the lamp makers but also the electricity supply industry and the lighting fittings makers, i.e. both private and public enterprise.

The new sponsors now have new premises which were opened last week and are described on page 103 of this issue. This new Lighting

Demonstration Centre enjoys the great advantage over the Savoy Hill Lighting Service Bureau that it can be seen by the public and has a bright attractive front. Inside, the best use has been made of the space available for the ingenious expression of ideas on lighting in its various spheres—industrial, commercial and domestic. It is not wrong that some of those ideas appear to be "advanced"; it is well for this kind of education to be always a little ahead of the patterns accepted by the public. Only in this way can there be progress. But, after all, the main purpose of the Centre is to educate the "experts" so that architects, builders and contractors can produce installations for a wider public to see and demand. The Council's new premises should enable this to be done even more effectively than in the past.

FUEL CONTAMINANTS

An illustration of the time and effort that may be saved by not striving to secure marginal accuracies in calculations beyond what is necessary for a specific purpose is provided by Technical Paper No. 4 just issued by the Boiler Availability Committee. In this document of 30 pages Messrs. K. Archer, D. Flint and J. Jordan describe physico-chemical methods developed by the British Coal Utilisation Research Association of analysing ash, slag and boiler deposits for determining the proportions of deleterious elements in the coal that lower combustion efficiency and increase maintenance costs.

The procedure depends on the use of a spectrophotometer and of a flame photometer now commercially obtainable. Tabulated comparisons with classical methods of achieving the same results indicate sufficiently close agreement for most practical purposes with an expenditure of only one-fifth of the time. This work appears to have a bearing on such matters as the blending of low-chlorine coals with those having a chlorine content of over 0·5 per cent, as is now being done by the Central Electricity Generating Board with promising results, more particularly with coal from the East Midlands area, as well as on the fouling of boiler exterior heating surfaces considered in the symposium of the Boiler Availability Committee held recently at the Institute of Fuel, a report of which appeared in the 2nd January issue of the *Electrical Review* (page 38).

BRITISH ALUMINIUM

The fierce struggle for the control of the British Aluminium Co., Ltd., ended last week in a victory for the company owned jointly by Tube Investments, Ltd., and Reynolds Metals, the American concern. T.I.-Reynolds claimed last Monday that they had acquired 87 per cent of the B.A. ordinary stock and hoped to reach 90 per cent, which would enable them to gain complete ownership. Thus the arrangement made by the B.A. board to issue 4½ million shares on "bonus" terms to the Aluminum Corporation of America was over-ridden.

During all the comings and goings of this business much has been made of the supposed "national interest" which was involved. In each case a strong American group has been concerned but both protested that they were not seeking to transfer control of British Aluminium to the United States. However that may be, American influence on the future of the company is bound to be strong, but not necessarily detrimental to British interests. In fact the company's need for large funds for development can probably be met only by American capital.

EMPLOYMENT SITUATION

Statistics of employment published in the December *Ministry of Labour Gazette* show that the total number of people in civil employment at the end of last October was 23,076,000, a decline of 1·07 per cent since the end of October, 1957. In the seven classes forming the electrical manufacturing groups there was a general decrease of 1·45 per cent in the number employed, but within the group there were ups and downs. The number employed in the electrical machinery section rose by 3·08 per cent to 210,600, those engaged in radio valve and lamp production by 1·90 per cent to 53,600 and those making batteries and accumulators by 4·86 per cent to 19,400. The falls were in electric wires and cables, by 7·82 per cent to 60,100; telegraph and telephone apparatus, by 5·06 per cent to 58,200; radio apparatus and gramophones, by 5·79 per cent to 136,600; and "other electrical goods," by 1·09 per cent to 181,500.

It should be said that the fall in the general total was entirely due to the fact that fewer women were employed. The decrease in their case was 5·55 per cent while the number of men was actually 1·03 per cent higher. There was a slight increase in the number of people employed in the electricity supply industry between the end of October, 1957, and the corresponding time last year. At 209,500 the total was 0·87 per cent higher.

VERITYS' AFFAIRS

While it was well known that Veritys, Ltd., had had some difficulties during the past year or two, the announcement that the company's bankers had presented a winding-up petition still came as a shock. It is never pleasant to see an old-established business in danger of disappearing and Veritys' name has been a household word in the electrical industry for very many years.

About two years ago negotiations for the acquisition of the company by Limit Engineering fell through, but now it seems that endeavours will be made to find a buyer. It is hoped that means will be found of continuing the business and with this in view the company is not opposing the appointment of a receiver or liquidator.

ELECTRICITY SUPPLY ORGANISATION

A revised version of the chart published last year showing the organisation of the electricity supply industry will be included in next week's issue of the "Electrical Review." Readers requiring extra copies of this issue should make early application

POWER STATION COAL HANDLING

DESIGN FEATURES OF SOME UP-TO-DATE PLANTS

By ANDREW SZOLD, Dipl.Ing., A.M.I.E.E., M.I.Mech.E.

In this country, power station coal usually contains a great deal of fines and sometimes clay in combination with a high moisture content which makes it difficult to handle. The specified handling rates of some plants are more than 1,000 tons of coal per hour. In one case, 1,600 tons of coal is required per hour, that is more than 9 cwt a second. In the following pages, some typical design features of power station coal handling plants are described. Many of these features are also applicable to plants handling materials other than coal

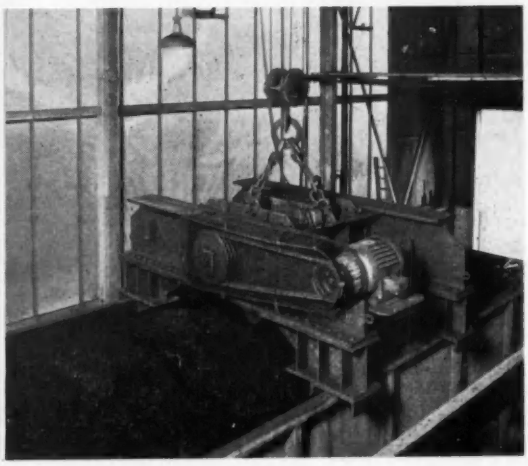
THE majority of up-to-date power stations in this country receive coal in railway wagons. In the following paragraphs whenever wagons are referred to, it will be assumed that they are made of steel. Box type wagons have been mostly used in the past. To discharge these wagons, each one has to be uncoupled from the rest of the train and then discharged by a wagon tippler. The two main types in use are the side tippler and the rotary tippler. In each case the wagon is hauled on to the tippler platform and is then tilted, being automatically clamped during the operation. With the side tippler the wagon is discharged into a hopper which is at the side of the railway track. With the rotary tippler the wagon is fixed between two large rings which are fastened together to form a cage-like structure. The cage is rotated and the discharged material falls into a hopper situated under the rail track level.

The side tippler has the following advantages: the space above the tippler platform is free and therefore any locomotive can pass over the tippler, provided the supporting structure is made accordingly; it needs comparatively little excavation as the top of the receiving hopper for the discharged material is above rail level and it is comparatively easy to include a weighing machine with the platform.

Fairly rapid cycles for emptying wagons by side tipping have been achieved. It has been possible to empty a wagon of about 30 tons gross weight in 40 sec. This time includes a 5 sec rest in the highest tipping position but no weighing. To cope with badly flowing coal it is desirable to tip the wagon so that the longitudinal side faces come to an inclination of 60 deg towards the horizontal, that is a tipping rotation of 150 deg.

The rotary tippler needs more excavation than the side tippler as the receiving hopper top is under rail level, and the rings have to be made large enough for a shunting locomotive to pass through, or some dimensions of the locomotive have to be reduced. For some time it was

Fig. 1.—Wagon shaker on top of railway wagons



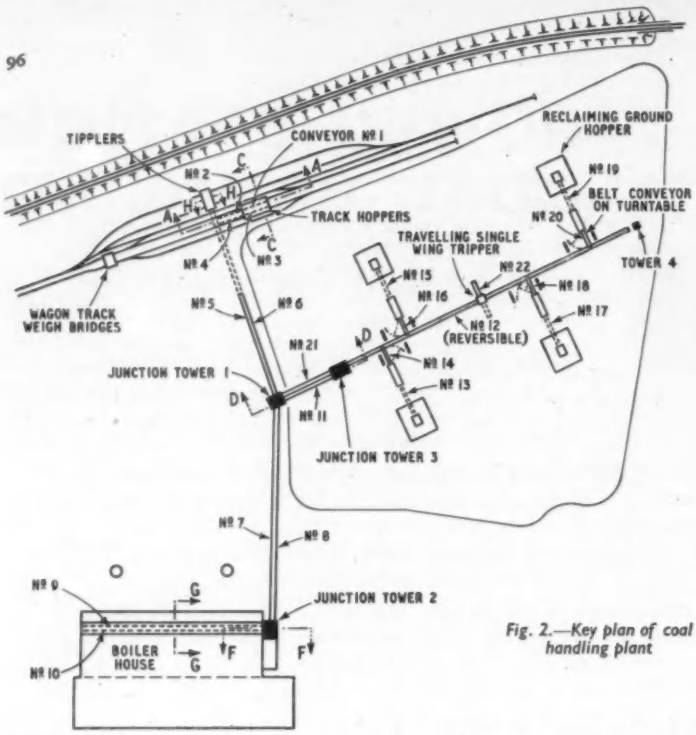


Fig. 2.—Key plan of coal handling plant

difficult to include a suitable weighing machine in this type of tippler, but recently this difficulty seems to have been overcome.

If the wagon platform of the rotary tippler were made in the form of a grille, it would appear to have the advantage of dealing with hopper type and box type wagons. The hopper wagon could be emptied through the grille of the platform, in the case of free flowing coal, without using the tippler, just by opening the wagon hopper doors. Sticky coal adhering to the wagon sides could be discharged from hopper wagons by using the tippler, assuming, of course, that the hopper had the necessary reinforcements for tipping without incurring any damage.

Hopper Wagons

Hopper wagons have been used in the past for the supply of coal to power stations in the North-East and in the Midlands, but they are likely to be used more generally in the future. To speed up the traffic of mineral wagons, it is proposed to fit these wagons with vacuum brakes; it is, however, a comparatively lengthy procedure to uncouple and recouple the wagons as they pass through the tippler.

It has been possible to modify the large-capacity hopper type wagon to make it fairly self-discharging for average power station coal. This modified wagon has a carrying capacity of 24½ tons of coal, it has four doors at the hopper outlets, and the valley angle at any hopper pocket is not less than 45 deg towards the horizontal. It has the necessary reinforcements so that it can be used with tipplers, if required. This wagon has only one pair of axles and its height above rail level goes almost to the top of the wagon gauge so that it makes a very economical use of railway sidings. The self-discharging characteristic of this wagon compares very favourably with older type hopper wagons which have shallower valley angles and only two doors.

Wagon shakers have been applied to facilitate the discharge of badly flowing coal which adheres to the sides of the hopper type railway wagons.

One example consists basically of an eccentric weight being driven by an electric motor through a V-rope drive, similar to a vibrating screen drive. The whole drive is fitted on to a substantial steel structure which is positioned on to the upper edges of the wagon. When the shaker is operated it imparts hammer blows to the upper edges of the wagon sides and thereby loosens the adhering coal. The amplitude and the frequency of the vibration can be varied. Higher frequency and a higher amplitude are required under freezing conditions. The springs at the wagon axles prevent detrimental vibrations being transmitted to the rail carrying structures.

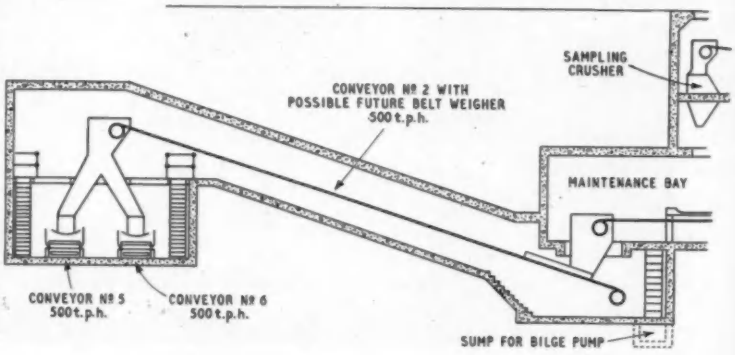
At one power station without the wagon shaker three men had to be employed under summer conditions to discharge a 21 ton capacity wagon. With the wagon shaker only two men were required and the discharge time was reduced by 30 to 40 per cent. At the same station, under severe winter conditions, six to eight men had to be employed to discharge the above wagon without a shaker. With the wagon shaker only four men were required whose duty consisted mainly of breaking up large pieces of coal which passed through the wagon doors but were too large for the ground hopper grid.

A hoist is used for positioning the shaker on the wagon. The hoist is fitted with a slack rope switch interlocked with the shaker and winch motors to ensure that the shaker can be operated only when it is resting on the wagon. The shaker positioning and operation is push-button controlled.

The Hewitt-Robins wagon discharger is reported to cause less damage to wagons than manual hammering, and it has been approved by the British Transport Commission for use on steel wagons. Fig. 1 shows this type of discharger on a hopper type railway wagon.

Typical Arrangement

Representative features of modern coal handling systems are most readily described by reference to a typical scheme. Fig. 2 shows the key plan. Wagon track weighbridges are provided to weigh the full and empty wagons. Shunting locomotives haul the wagons over the weighbridges. The full wagons are brought over two longitudinal track hoppers of the slit type, each


SAMPLING CRUSHER
CONVEYOR Nº 2 WITH POSSIBLE FUTURE BELT WEIGHER 500 t.p.h.
MAINTENANCE BAY
CONVEYOR Nº 5 500 t.p.h.
CONVEYOR Nº 6 500 t.p.h.
SUMP FOR BILGE PUMP

capable of accommodating three high-capacity hopper type railway wagons for simultaneous discharge. As can be seen in Fig. 3, the hoppers are long enough to allow for inaccurate shunting.

Longitudinal slots are provided near the bottom of the hoppers through which travelling paddle feeders feed the coal on to belt conveyors as shown also in Fig. 4. These hoppers have the advantage that they have only two inclined faces and therefore the risk of coal sticking is minimised. The hoppers are made of reinforced concrete with mild steel grids on the top for safety of the operators. Provision is made for vibrating the grids by electro-magnetic vibrators to dislodge any sticky coal.

High-level platforms with suitable crossovers are installed. An operator walks along these platforms and whenever he sees coal adhering to the wagon sides he places and operates the wagon shakers by push-button control. The wagon shakers can travel on longitudinal overhead joists. Coal can, of course, also be removed from the wagon sides with light long shovels by operators standing on the high-level platforms. The capacity of the hoppers provides enough space to take at least the contents of two 24½ ton capacity wagons at each wagon pitch.

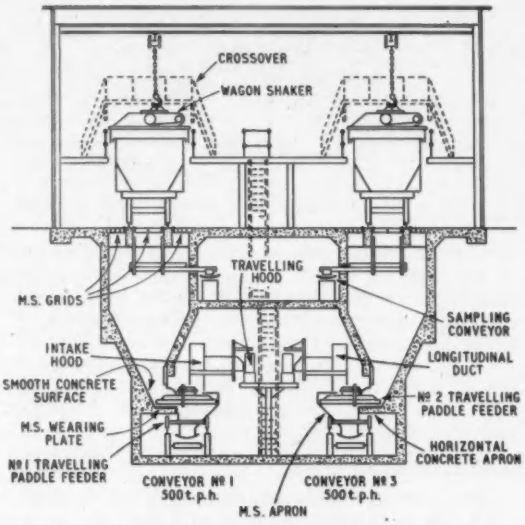


Fig. 4.—Cross-section through wagon unloading hoppers

Travelling Paddle Feeders

Two travelling paddle feeders are included, one at each hopper. Provision is made for the possible future installation of two more travelling paddle feeders so that, in this case, two feeders can operate at each hopper. Each feeder has a basic capacity of 500 tons per hour and travels on its rails at an average speed of 10 ft/min. The feeder has a vertical spindle paddle wheel. The wheel has six arms with cutting front edges and the arms are suitably curved.

The paddle wheel is mounted on a travelling carriage. A cam in the form of a bent rod is fastened on to the carriage. This cam engages channel pieces or rollers fixed on hinged mild steel doors which are placed all along the longitudinal discharge slot of the hoppers. The doors close by gravity so that, as the feeder travels along, the doors are lifted up to provide sufficient clearance for the paddle, and then lowered to provide a suitable seal to obviate spillage of large-size coal which may fall from the wagons into an empty hopper.

The cutting edges of the arms are made of wear-resisting material and are arranged for easy replacement. The paddle wheel drive and carriage travel drive have separate electric motors. Both of the drives include the necessary gear box to vary the feeder capacity from 500 to 250 tons/hr, and to give a variation of the travel speed of plus or minus 25 per cent. A traction type fluid coupling is included in the paddle wheel drive at its high-speed side to prevent damage in case of jamming. An electromechanically operated brake is included in the travel gear.

Adjustable stops are provided along the travel rails for the two feeders to operate reversing switches for the travelling motion. Fixed stops are included at the ends of the travel rails. The stops are so arranged that it is

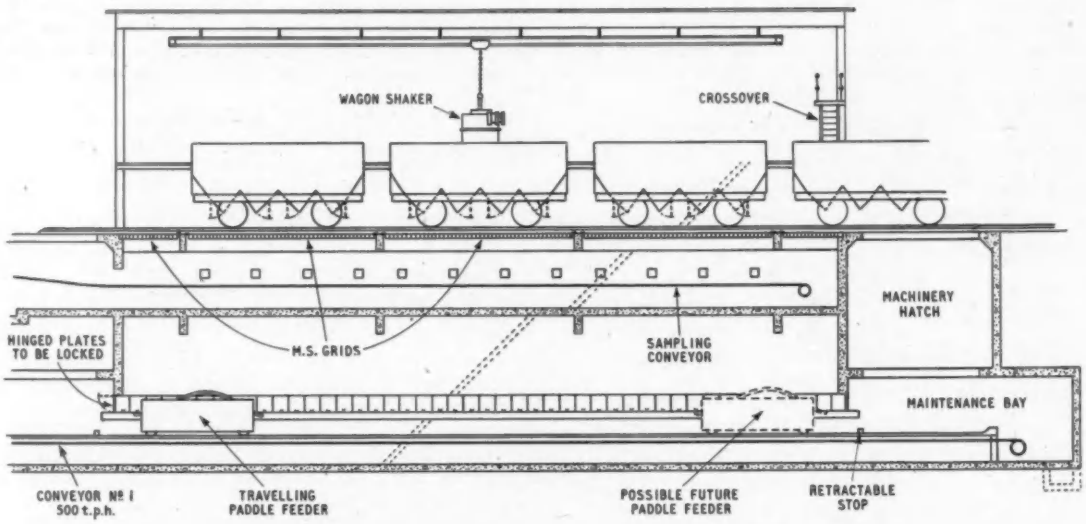


Fig. 3.—Longitudinal sections through wagon unloading hoppers and adjacent belt conveyors

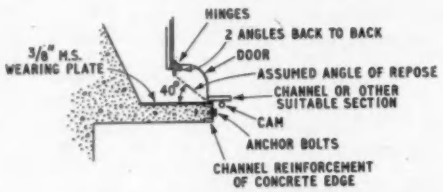


Fig. 5.—Arrangement at the hopper slots

possible to operate any feeder along the whole length of the hoppers or two feeders simultaneously with reversing stops near the middle of the hopper length. Any feeder can be withdrawn into its maintenance bay.

The power supply is by means of a self-reeling cable drum and a multi-core flexible cable. The paddle wheel housing is joined with an apron and skirtplates for feeding the coal on to the conveyor. Fig. 5 shows the arrangement at the hopper slots.

Dust Extraction

The ductwork of a dust extraction plant is designed to avoid risk of formation of an explosive air-coal dust mixture in this underground paddle feeder chamber. An intake hood is fixed over each paddle wheel. The air-dust mixture goes from the hood, through the duct feed carriage, into a longitudinal duct. There are two longitudinal ducts, one for each conveyor in this chamber. The duct feed carriage has trod wheels travelling on angles situated at the top edges of this duct. The feed carriage is pushed along by a driving arm attached to the paddle feeder structure. A flat conveyor belt forms the sealing cover on top of the longitudinal duct. This belt is automatically raised and lowered by rollers on the feed carriage.

Other Discharge Facilities

If box wagons were inadvertently received at this station, they could be discharged by a tippler. The lay-out is so arranged that more tipplers could be installed so that, if necessary, all wagons for the whole station can be emptied by tipplers only. The tipplers are of the weighing side-discharge type.

The time cycle of the tippler for a 24½ ton capacity wagon with a final tipping angle of 55 to 60 deg is given in the table.

The weighing machine of this tippler includes an automatic totalising equipment adding up the net weights of a string of wagons. The weighing operation with the totalising equipment takes longer than with a weighing machine of the usual dial type without totaliser, but it is a more "foolproof" equipment. A ticket printing equipment is included for the record of individual wagon weights.

Time cycle of weighing side-discharge tippler

Time to weigh full wagon	50 seconds
Time to elevate full wagon to final tipping position	27½ seconds
Time for rest in final tipping position (required)	5 seconds
Time to lower empty wagon	27½ seconds
Time to weigh empty wagon	15 seconds
Time for shunting	25 seconds
Total time cycle	150 seconds

Tippler Hopper

Fig. 6 shows a longitudinal section of the tippler hopper with the feeding arrangement over the belt conveyors. The hopper capacity is made large enough to take the coal from two high-capacity wagons and has twin outlets. There is a water collecting gate with electromagnetic vibrating feeder under each outlet. The feeders discharge into a bifurcated chute with a flap valve so that both have to operate all the time irrespective of whether one or both conveyors are running underneath. In this way no sticky dead coal can accumulate in the tippler hopper. Adjustable baffle plates are provided in the bifurcated chute, with regulating facilities outside the chute, to facilitate the central loading of the belt conveyors.

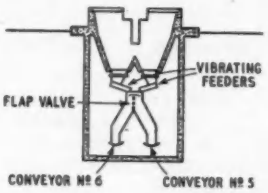
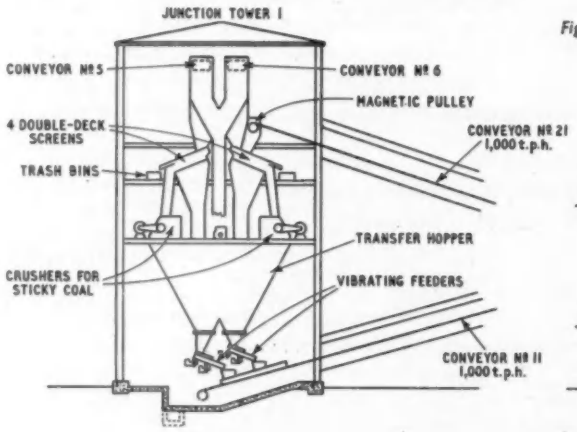


Fig. 6.—Tippler hopper with feeders and conveyors

Flow of Material

The coal discharged from the wagons is brought by belt conveyors to junction tower No. 1 where the crushers and screens are situated (Fig. 7). After the coal has been reduced to the required size, it is conveyed either to the coal bunkers in the boiler house or to the open coal store. The coal is spread from initial piles on the coal store by tractors. When the coal is to be reclaimed from the store, it is discharged by tractors into any of the four ground hoppers and from there it is brought into the boiler house.



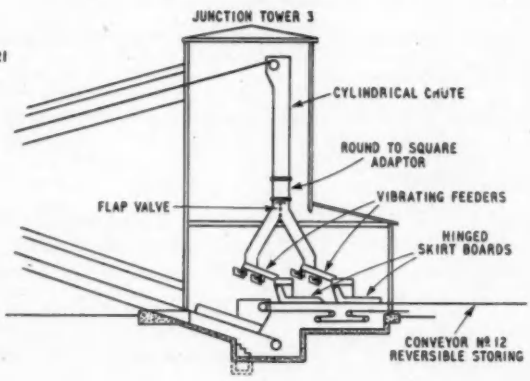


Fig. 7.—Junction towers Nos. 1 and 3 showing crusher house and feeding arrangement of reversible belt conveyor

The moisture content of washed smalls received by railway wagons is expected to be up to 20 per cent, and the coal reclaimed from stock may have a total moisture content up to 25 per cent. To facilitate the flow of this potentially sticky coal, the smallest valley angle of any hopper or chute is not less than 60 deg towards the horizontal.

It has usually been found more economical to reduce oversize coal in separate crushers than to rely on the pulverised fuel mills in the boiler house to disintegrate coal which is above ¾in mesh as otherwise the output of the mills is reduced. Only crushed coal is stored out at the open coal store in order to reduce air pockets in the coal heap to the minimum and thereby lessen the danger of self-ignition.

In-line overband magnetic separators, to extract tramp iron from the coal, have been included near ground level on all belt conveyors delivering material into junction tower No. 1. These are preferable to separate magnetic pulleys, as with the latter, the tramp iron chute is situated between the pulley and the belt scraper gear, and a great deal of sticky coal, that adheres to the conveyor belt, falls through the tramp iron chute before it reaches the scraper gear. With the large quantities of coal involved, this can cause a considerable nuisance.

Non-magnetic impurities like pieces of wood, rags, and non-ferrous castings, are extracted from the coal by trash screens. These impurities, if not separated, can cause considerable hold-ups in the chutes of the pulverised fuel mills in the boiler house. There are two sets of screens included for this purpose: the double-deck screens in junction tower No. 1 and the trash screens in junction tower No. 2 adjacent to the boiler house.

At the double-deck screens the upper deck rejects large pieces of impurities from the coal, but lets through all coal of 3in mesh and below. The impurities are discharged into a chute and from there into a suitable receptacle. The lower deck lets through ¾in mesh coal and coal of smaller sizes. Coal larger than ¾in mesh is discharged from the screens into chutes feeding the crushers. Four double-deck screens are included, each suitable for an intake of 250 tons/hr. By-pass chutes are included for the coal to by-pass the above screens and the crushers.

The trash screens in junction tower No. 2, shown in Fig. 8, have a mesh of 1½in to deal with trash coming through the crushers or from the store. The coal from the store does not pass through the crushers. Four trash screens are included here, each capable of dealing with 250 tons/hr.

The four crushers included in junction tower No. 1 are designed for crushing sticky coal from 2in cubes to a uniformly graded output capable of passing through a ¾in mesh. The salient features of the type of crusher used can be gathered from Fig. 10. It consists, basically, of heavy breaker plates forming a chain, which passes over a heavy anvil type steel construction to absorb shocks. The revolving crusher rotor with its fixed hammers breaks the coal up against the chain. The moving chain shakes off the sticky material adhering to it.

Transfer Hopper

The double-deck screens discharge the small-size coal, and the crushers discharge all their output into the transfer hopper so that various grades of coal can be suitably mixed. There are four outlets at this hopper and an electromagnetic vibrating feeder under each outlet. Two feeders supply coal to two conveyors going towards the boiler house. Another two feeders supply coal on to conveyor No. 11 towards the store. These vibrating feeders help to disintegrate the coal during feeding (Fig. 7).

Coal reclaimed from the store comes into the transfer hopper without going through the double-deck screens or crushers. Two high-level control switches are included near the top of the transfer hopper. These switches are suitably interlocked with the appropriate conveyor driving motors.

Coal Sampling

The main coal samplers included in some plants are "Geco" type samplers which are shown in Fig. 11. The "Geco" sampler consists of a small traversing chute or cutter made of stainless steel, sliding on rollers in the main discharge chute under the conveyor head pulley. The reciprocating traversing mechanism consists of a motor-driven worm reduction and roller chain gear. A suitable switch for reversing the electric motor in an adjustable time cycle is included. The traversing mechanism and all electrical parts are protected against the ingress of dust. The opening of the traversing chute can be adjusted.

Under the bottom opening of the traversing chute are

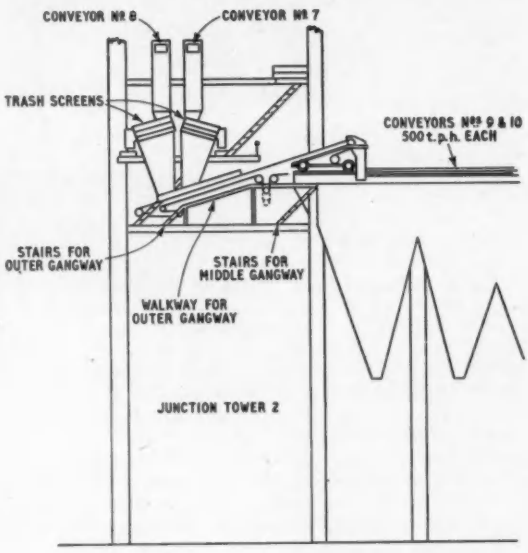


Fig. 8.—Junction tower No. 2 showing trash screens and travelling tripper

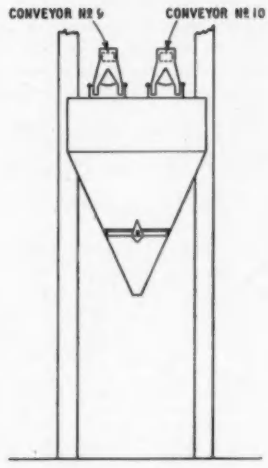
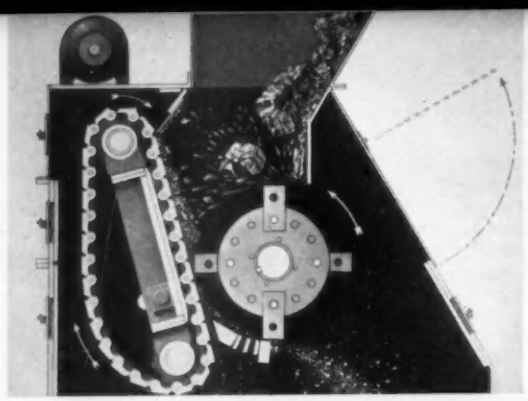


Fig. 9.—Travelling trippers over coal bunker with pressure breaker



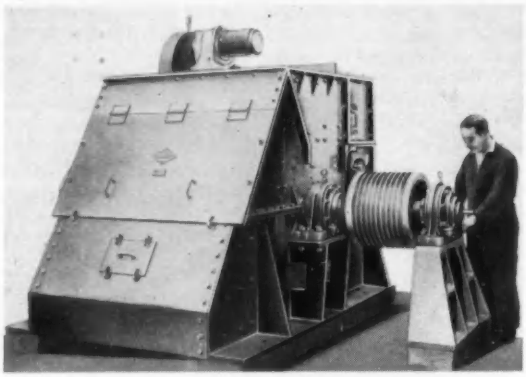
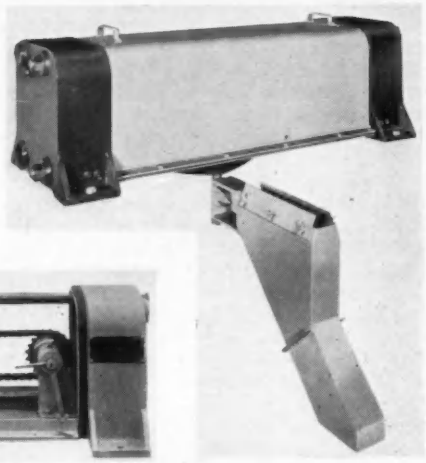


Fig. 10.—"Mud Hog" crushers for sticky coal



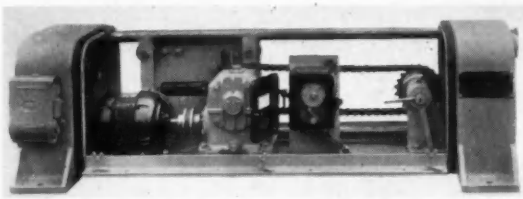


Fig. 11.—"Geco" sampler

shown in Fig. 2. The wing tripper, moving on rails at ground level, travels between junction towers Nos. 3 and 4, and forms longitudinal heaps of coal parallel to the main belt conveyor. From these heaps the coal is spread out over the coal store by mobile equipment such as bulldozers or tractor shovels.

When reclaiming, the coal is brought by mobile equipment into any of the four ground hoppers, which are linked by separate belt conveyors with the long reversible belt conveyor which is then running in the opposite direction. This reversible storing and reclaiming belt conveyor has a 54in wide belt running at a speed of 420 ft/min. When storing out, the conveyor receives coal in junction tower No. 3 as shown in Fig. 7.

A dual motor drive has been included to obtain good troughing of the belt, to economise in the number of belt plies, and to facilitate the starting of the conveyor under inclement weather conditions. In this case, one motor with its driving gear is installed at the discharge pulley in junction tower No. 3 and the other motor with its driving gear is mounted on a travelling carriage pulled by a counterweight in tower No. 4. Both motors operate all the time irrespective of the direction of the belt travel.

The travelling carriage is used to compensate for any temporary belt elongation. The permanent belt elongation is dealt with by a screw type take-up in junction tower No. 3 on the return strand of the belt (Fig. 7).

The wing tripper carries a single-wing conveyor which can be rotated to discharge on either side of the reversible belt at a rate of 1,000 tons/hr. The tripper travel speed is about 25 ft/min. Suitable ploughs are fitted near the travel wheels to clear the track of coal.

The tripper travelling, slewing motion and wing conveyor drives are by separate motors. The controls for

arranged a series of spreader chutes separating the coal for the sampling crusher from the coal which is returned to the main coal stream. A separate sampling crusher for dealing with the sampled coal is installed.

Where there is a likelihood of different qualities of coal being discharged into the same hopper and a representative sample is required quickly, without waiting for the hopper to be emptied of the previous consignment and to obviate delaying the operating cycle of the wagon discharge, it has been considered suitable to include small chain link conveyors for sampling within the hopper. These can link up with a small coal sampling belt conveyor discharging into a sampling crusher and from there to other parts of the sampling plant as can be seen in Fig. 3.

A long reversible belt conveyor operates in conjunction with a travelling wing tripper for storing coal out as

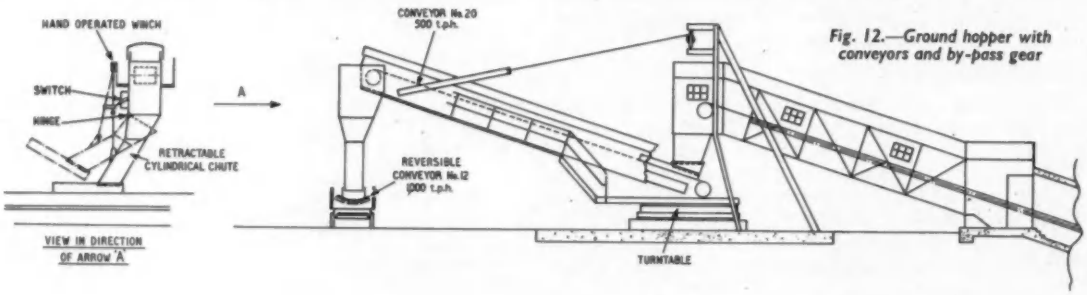


Fig. 12.—Ground hopper with conveyors and by-pass gear

these motors are arranged in the form of suitable pendant control switches suspended on brackets on each side of the wing tripper to permit control from coal store ground level. A thruster-operated brake is fitted on the travelling motor shaft. Check pulleys are included at the rising part of the longitudinal belt to obviate excessive lifting when this conveyor is started in the opposite direction.

Adjustable stops, spaced at about 100ft pitch, are provided at travel rails to operate reversing switches for the travelling motion in either direction. These stops are included only between conveyors Nos. 14 and 18. Rail clamps are included in the form of double jaws engaging the top side faces and the top lower inclined faces of the rail bulb. Fixed limit switches are fitted at the end of the tripper travel near the junction towers Nos. 3 and 4. Suitable interlocks are included to obviate any fouling of the tripper with the conveyors from the ground hoppers and to ensure that the tripper is in the correct position during reclaiming.

The power supply for the wing tripper can be arranged with current collection equipment and conductor wires, or with a self-reeling cable drum having an automatically-operated take-up gear for a multi-core flexible trailing cable. In the latter case, a multi-pole plug is connected to the cable and swivelling, weatherproof, plug boxes, with suitable clamping parts to avoid any strain on the conductors, are included along the tripper travel path.

The rail gauge distance of the tripper travel wheels is made to a close limit to avoid excessive clearance and to facilitate the central running of the reversible belt. For this reason tie bars are also fitted between the rails at approximately 10ft pitch.

Ground Hoppers

Four ground hoppers are installed for reclaiming. The approximate hopper positions, as shown in Fig. 2, have been obtained by dividing the store area into four fields. The hoppers are placed approximately at the centre area of each field to provide the minimum travelling distance for the mobile coal handling plant during reclaiming. The distance of each hopper from the reversible belt conveyor is the same and, therefore, the conveyors linking up the hoppers with the reversible belt are of equal lengths.

The reclaiming equipment for each ground hopper is shown in Fig. 12. The hoppers have twin outlets. Under each outlet is a water collecting gate with an electromagnetic vibrating feeder. The two feeders feed the coal on to a short inclined conveyor which discharges on to a radial conveyor. The latter brings the coal on to the reversible belt conveyor. The radial conveyors have a slewing gear to allow the wing tripper to pass. The slewing gear at each radial conveyor is similar to that included for the wing tripper, but the slewing angle is only 90 deg. Limit switches are included for the slewing motion.

The lower part of all feeding chutes for the reversible belt are made cylindrical to facilitate central feeding. The skirtplates of all feeding chutes over the reversible belt are made retractable with appropriate electrical interlocks for the respective belt travel. The slewing gear of the radial conveyor can be operated only when the hinged chute is in the retracted position.

A mild steel grid is fitted above each ground hopper. The grid is provided for the safety of the operators and to exclude impurities from the coal. As the coal becomes fairly compacted by the mobile equipment, it may not fall through a hopper grid of small mesh. Therefore the grid is made with a permanent mesh of 2ft by 6in with intermediate notches for the insertion of bars which are so arranged that when the bars are in position they provide an overall mesh of 6in by 6in. The bars can be removed or put into position as operational experience dictates. To assist further the passage of sticky compacted coal, each grid can be shaken by electric vibrators. The latter have to be adequately protected against the ingress of moisture and coal dust.

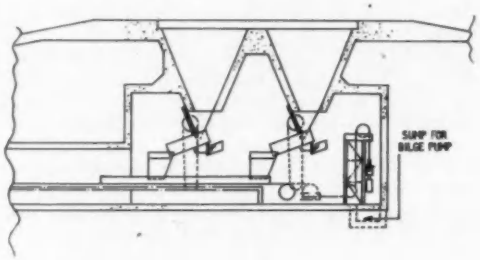
The reclaimed coal is carried from the reversed belt conveyor and the inclined belt conveyor No. 21, shown in Fig. 7, into junction tower No. 1 and discharged directly into the transfer hopper. From the transfer hopper the coal is carried then by the conveyors Nos. 7 and 8 to conveyors Nos. 9 and 10 which discharge it through travelling trippers into the boiler house coal bunkers (see Fig. 9).

The trippers are of the automatic travelling type, arranged to permit the coal to be discharged throughout the whole length of the bunkers or any predetermined length as may be required. The tripper travelling speed is about 25 ft/min. Each tripper is driven by the respective conveyor belt and the tripper is automatically reversed at each end of the run. There are fixed reversing stops at the extreme ends and adjustable reversing stops for any selected intermediate length over the bunkers. Provision is made for easy clamping of the tripper on to the rails so that it can operate in a stationary position. The travel brakes engage the top side faces of the travel rails, thereby providing a positive grip on that part of the rail surface which is least likely to be covered by coal dust. It is possible to operate the brakes and travel reversing mechanism from either side of the conveyor. The brakes are so interlocked with the travel mechanism that they cannot be operated unless the tripper travel motion is out of gear and vice versa.

The bunker top is designed to prevent unauthorised access into the interior. The spillways under the tripper chutes consist of $\frac{3}{4}$in diameter mild steel bars arranged parallel at about 6in pitch, forming longitudinal slots square to the tripper travel.

Pressure Breakers

To make "bridging" or "funnelling" of coal less likely in the bunkers, pressure breakers have been included in some of the bunker pockets. They are diamond-shaped steel bodies fixed by spiders to the hopper sides as shown in the lower part of Fig. 9.



Acknowledgments

The author wishes to thank the Central Electricity Generating Board for permission to write this article and particularly Mr. J. W. H. Dore and Mr. F. Dransfield for their help in preparing it. Further thanks are extended to Air Control Installation, Ltd., British Geco Engineering Co., Ltd., British Jeffrey-Diamond, Ltd., and Stone-Wallwork, Ltd., for their permission to publish their respective drawings and photographs.

New Books

An Introduction to the Theory and Practice of Semiconductors. By A. A. Shepherd. Pp. 206. Constable & Co., Ltd., 12, Orange Street, London, W.C.2. Price 18s 6d.

This excellent introductory work, written by the head of the semiconductor laboratories of Ferranti, Ltd., incorporates in part a review article previously published by the British Institution of Radio Engineers. It is intended to serve as an introduction to semiconductor practice, in particular the preparation of monocrystalline material and the controlled addition of the minute amounts of impurities necessary to enable semiconductor devices to be made. No circuit applications are described, although there are references to one or two specific applications of particular devices, e.g. the junction photocell solar battery.

The opening chapters contain a rapid but intelligible résumé of the band theory of solids, intrinsic and impurity semiconductors, and temperature variation of conductivity, followed by the experimental determination of carrier mobility, Hall constant, thermo-e.m.f. and resistivity. The behaviour of minority carriers is then discussed, and some techniques for the measurement of minority carrier lifetime are described. The main chapters of the book then follow, covering the preparation in single crystal form of germanium and silicon of the necessary purity; rectification and the techniques available for producing effective diode configurations; and transistor structures which have been constructed or proposed, including grown-junction transistors capable of operating up to 1,000 Mc/s. A further chapter covers germanium and silicon photocells, and the book ends with a brief survey of semiconducting compounds, some of which have possibilities of exploitation in devices, since they offer a wide choice of basic semiconductor parameters. The references given run well into 1956, and the preface is dated April, 1957. It is therefore unfortunate that a book on such a rapidly expanding field was not published until July, 1958.—P.L.D.

Electrical Maintenance and Repairs. By J. L. Watts. Pp. 324; figs. Cleaver-Hume Press, Ltd., 31, Wright's Lane, London, W.8. Price 21s.

Any publication which sets out to improve the knowledge and skill of the maintenance man must be a welcome addition to an engineer's library. In Mr. Watts' book we have an excellent attempt to cover the wide field of this subject. The book appears to have been written for the engineer in charge of a medium-size concern, as references give the impression of limited size: but since there are many more small to medium factories compared to the heavy industries perhaps this approach is justified. This does not mean that the book has no interest to the experienced engineer; it is full of information obviously gained in the field and manufacturers' test plants. The opening chapter rightly defines preventive maintenance and emphasises safety factors. Contrary to an opinion expressed, large concerns do have their own winding repair shops, and while no doubt outside firms do an excellent job, it is healthy to be able to stand on one's own feet when an emergency arises. Repairs by the makers are comparatively rare because of the time involved.

Useful examples of records and a motor history sheet are given, recording all essential factors. The section on the maintenance of contacts and oil circuit-breakers is good, but the reference to the isolation of enclosed switches would be improved by a suggestion that the operator should open switch enclosures to verify contact break and not rely wholly on handle operation.

There is a comprehensive chapter on earth leakage protection and methods of ensuring that apparatus is kept in serviceable condition, and the reference to 110 V systems with the centre tap earthed for portable tools can be recommended, although so far this system has not the full approval of the official authorities.

The folly of over-greasing ball and roller bearings is emphasised and the maintenance of commutators is dealt with, but this section could be improved by a paragraph about the use of diamond turning, which can often be done with the machine running at full speed in its own bearings. There is a good section on transformers, a clear instruction on testing oil samples being useful to firms without access to a chemical laboratory. The reaction to comments on maintenance of steel tank arc rectifier pumps and water cooling is that pumpless sealed units have now been supplied for over 16 years and banks of 300 kW units are preferable to single large units.

The section on cable faults is disappointing; technically it is correct, but as the book sets out to be of practical assistance to the reader, the chapter needs enlarging and divorcing from fluorescent lamps. Details requiring verification or addition include the toxic effect of the fire extinguishing media mentioned on page 12, the motor currents shown in Fig. 44, and the bearing clearances given on page 216. Finally, the tabulated fault-finding section should benefit the young trainee, and the appendices listing regulations and specifications were well worth including.—A.W.L.

Ceramic Fabrication Processes. Edited by W. D. Kingery. Pp. 235; figs. Technology Press of M.I.T. and John Wiley & Sons, Inc., New York; Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 76s.

This book is the result of a special summer programme at Massachusetts Institute of Technology on the principles and practice of ceramic processing. During the past 10-15 years there has been a substantial increase in ceramic research, and the electrical, electronic, aeronautical, atomic energy and other industries have found the development of ceramics with improved properties to be essential to technical progress. Further, increased automation and mechanisation, coupled with statistical quality control, have led to a desire for better control of ceramic processes. A major obstacle has been the complexity of the relationships between ceramic raw materials, processing methods, and final properties. Nevertheless, rapid advances have been made in some directions, such as in the ferroelectric, ferromagnetic and special electronic ceramics, and in automation and mechanisation of production of clay ware.

The bulk of the writing deals with the problems of preparing slips and casting them, dry-pressing and hydrostatically pressing powder, and plastic forming of clay-like bodies, followed in each case by drying and firing. Among special processes, hot-pressing can be used for a variety of refractory oxides and carbides, or a suitable refractory cement may provide the necessary bonding in the ceramic body, and controlled nucleation of crystallisation from glass can be utilised in the formation of ceramics. The effect of microstructure on both the electrical and magnetic properties, and the mechanical properties is considered in two final chapters.—P.L.D.

London Lighting Centre

OPENING OF BRITISH LIGHTING COUNCIL'S NEW PREMISES

ON Wednesday last week the new premises of the British Lighting Council at 16-18, Lancaster Place (Brettenham House), London, W.C.2, were formally opened by Miss P. Hornsby-Smith, Parliamentary Under Secretary, Home Office, in the presence of a large and representative gathering of electrical people including the President of the I.E.E., Mr. S. E. Goodall.

Mr. D. Bellamy, chairman of the Council, in a characteristically lively speech, explained the origins and purpose of the Council, giving due credit to the former Electric Lamp Manufacturers' Association whose Lighting Service Bureau was the forerunner of the new lighting demonstration centre. The Mayor of Westminster (Councillor D. Cobbold) then extended a welcome to the Council into his area and showed that the Westminster City Council was fully alive to the need for and advantages of good and plentiful lighting.

In declaring the new centre open and switching on the

Views of the new London Lighting Centre

1. Wall showcases in the shop section with an internally-lighted counter on the left. 2. Conference room with attractive ceiling lighting and wall panels. 3. An artificial window in the domestic section with a selection of filament lamp fittings. 4. Lower ground floor room. Inset: The Lancaster Place entrance through which a good view of the interior is obtained

main lighting in the conference room, in which the ceremony was held, Miss Hornsby-Smith referred to her early connection with the electrical industry and commended the work of the Council in raising the standards of lighting in industry, commerce and the home.

The arrangements in the new premises, although restricted in scope by the comparatively limited space available, are such as to give a good general idea of the systems, effects and equipment available. In the main hall, for instance, the principal feature is the modular panelled ceiling fitted with two types of fluorescent lighting with variable dimming control. On one of the walls is a series of six translucent panels with designs executed in stained glass and plastic materials embedded in transparent resin. Here also is a selection of ceiling mounted and suspended fittings.

Two demonstration shop windows and domestic lighting design ideas are to be seen in another section while industrial and commercial lighting are dealt with in a lower floor reached by an open staircase.

To compensate for the limitation on the number of designs which can be actually displayed a comprehensive photographic index is maintained. This consists of several hundred pictures of fittings made by members of the supporting bodies and projection apparatus is available to illustrate as far as possible the effect obtained by using the apparatus included in the index.

Readers may be reminded that the British Lighting Council was formed by the British Electrical Development Association, the Electric Lamp Industry Council and the Lighting Equipment Development Council. The B.L.C. has regional offices in Manchester, Newcastle-upon-Tyne, Leeds, Birmingham, Bristol and Glasgow.

Mr. W. J. Jones is director of the Council and Mr. E. B. Sawyer the secretary. The architect of the Lighting Demonstration Centre was Mr. Hulme Chadwick.

TRANSFORMER MANUFACTURE IN INDIA

IN 1957 the aggregate capacity of electric transformers manufactured in India rose to 1,250 MVA, and units with individual ratings of 5 MVA, 110 kV, were produced for the first time. The total value of production was about Rs.50 million. However, this did not prevent a continued expansion in imports, which in 1957 amounted to an aggregate capacity of 755 MVA, valued at Rs.26·5 million. Over 63 per cent of the imports (by value) were units over 33 kV and, on another basis of calculation, those above 2·5 MVA represented 47 per cent (by value) of the total.

These figures are given in an article in the October issue of the *Indian and Eastern Engineer*, in which it is also estimated that the present annual capacity of Indian transformer makers is 1,800 MVA on a single-shift basis. The author of the article is Mr. S. Szafranski, A.M.I.E.E., transformer manager, National Electrical Industries, Ltd., Bombay. By the end of the second five year plan in 1961, when local production should have reached 1,900 MVA, Mr. Szafranski suggests that the country's transformer requirements could be met with imports cut down to Rs.14 million. This presupposes, however, that local manufacturers are given sufficient incentive to develop units of higher ratings and voltages, as it is mainly these that will have to be imported for some time.

There are at present seventeen licensed transformer manufacturers in India (some smaller distribution transformers are also made by other manufacturers) and the four main centres of production are Bombay, Calcutta, Madras and Bangalore. Among the types of transformers made are units with on-load tap changing gear for voltages up to and including 66 kV; neutral gas-sealed transformers; non-inflammable liquid-filled and dry type Class H transformers; mining and trans-switch units for work underground; and mobile substation assemblies. The direct labour force is estimated at 3,000 and the staff at up to 450.

Transformer manufacture in India is very much dependent on imported materials, several of which carry high rates of import duty. Mr. Szafranski suggests that to encourage local manufacture the duties on materials should be reduced and the revenue maintained by increasing the relatively low protective duty on transformers above 3 MVA. To reduce the industry's dependence on imports efforts are being made to develop the local manufacture of cooling tubes, certain grades of insulating materials, and accessories such as de-hydrating breathers. Progress in the local manufacture of bushings is said to be "most disappointing" (120,000 bushings were used in 1957) and the author complains that nothing has been done with regard to electrolytic copper refining and the manufacture of the higher grades of electrical steel. Production of even the lower grades dropped considerably in 1957.

Some 1,000 tons of insulated copper strips and wires, 2,450 tons of silicon steel sheets, 1,500,000ft of cooling tubes, and 2,300 tons of mild steel plates and sections were used during 1957, the greater part being imported. Although the raw materials for making press board are easily available in India, the annual consumption of 200 tons a year is said to be too low to attract commercial production without Government assistance. On the other hand, the requirements of the manufacturers and of transformer users for transformer oil, each estimated at about 600,000 gallons a year and at present entirely imported, would justify a small refinery, which could also include a section for reconditioning oils.

Over the past three years manufacturing costs have risen but at the same time keen competition, especially in small transformers, has kept prices at low levels. For certain sizes there is probably no profit and the article suggests that it might have been wiser to have encouraged the development of established manufacturers and to have restricted entry into the field. Most manufacturers now quote five months' delivery for transformers below 500 kVA and about seven to eight months for larger units. Transformers above 2 MVA can usually be supplied in about twelve months. The new Indian standard for transformers up to 100 kVA and 11 kV has been shown to reduce manufacturing costs by up to 11 per cent compared with previous local specifications. An analysis of the sales of one manufacturer shows that during the period 1949-57 Government Departments took 67 per cent, private industry 21 per cent, and municipal undertakings and private electricity undertakings 6 per cent each.

Heavy-Oil Engines

THE report of the Diesel Engineers' and Users' Association for 1957-58 lists leading particulars of 45 generating stations in Britain and 37 abroad and of 26 water pumping stations in Britain. Statistics are given relating to kWh generated and itemised costs of operation and maintenance. A section dealing with notes and comments from users concerns practical problems in operation and suggestions for improvements. References are made to automatic starting and stopping of engines in accordance with load demands which is coming into extended use, resulting in economic gains from more elaborate instrumentation. One user reports more satisfactory performance, notably as regards wear, by this means. The U.K. manufacture of diesel engines in 1957 is stated to have amounted to 102,766 units above 50 b.h.p. aggregating nearly 4 million b.h.p. and valued at over £43 million.

VIEWS on the NEWS

By REFLECTOR

QUITE a number of "house" magazines reach me. Some I read and some I merely skip through until some point catches my eye. These publications are produced in great numbers nowadays; almost every organisation with a staff (office and works) of any size runs one and some of them are extremely well done. My prolonged examination of these journals leads me to the conclusion that they fall into three classes so far as content is concerned. Some are severely practical, dealing almost wholly with the products and business of the organisations to which they relate. Others are devoted mainly to the social and personal activities of the staff (these are strictly staff magazines). A third class is the literary variety which consist practically entirely of articles—not necessarily related to the company's affairs but customarily by members of the staff. A good recent example of the last type is the (rather belated) "Autumntide" issue of *Beacon* published by Aberdare Cables, Ltd., South Wales Switchgear, Ltd., and associated companies. The contributions to this cover such subjects as the Chinese Republic, arc suppression coils, Somerset church towers, the production and uses of zinc, and champagne. A double-page reproduction of a colour photograph of the Elan Valley by Mr. A. J. Nicholas is a special feature.

* * *

There is a general feeling among the electricity supply authorities here and, naturally, among electrical contractors that electrical "Do It Yourself" should be discouraged. On the other hand, Mr. J. A. Steele, the president of the New Zealand Electrical Supply Authorities' Industrial Union of Employers (a nice compact title) recently advocated that the home handyman should be instructed rather than discouraged. As reported in *Live Lines* (the journal of the Electrical Supply Authorities' Association of New Zealand):—

> "He commented that there had been very few serious accidents through work done by handymen. While he had been opposed to unauthorised work, he felt that it was difficult to restrict repairs to properly qualified persons and the industry should move with the times. On the score of safety, it would be reasonable to offer some instruction."

Mr. Steele gave no indication how far this instruction should go. The ambitious handyman will embark upon the most comprehensive wiring scheme, although it takes five years to make a qualified journeyman electrician.

* * *

Most of the diaries which I receive contain a good deal of useful electrical information in a compact form although it is not always that one finds what one is looking for. But what I really like about these diaries is the more general matter they embody which is a good stand-by when one has a few minutes to spare with no reading matter ready to hand. One fascinating section is the table of elements and their atomic weights in which are included names which one seldom sees elsewhere, e.g. praseodymium, promethium and dysprosium. There is evidence of transatlantic influence in some others—columbium, berkelium, Americium and californium, the last three being principal isotopes of uranium. Then there are the little maps which incline one to the belief that China and Peru are much closer to one another than they really are. Many diaries also include diagrams of London's Underground railways, which do not run so straight as they are depicted and link such disparate localities as Aylesbury and Wapping. I am grateful to the compilers and senders of these little compendia.

* * *

Correspondence on "amenities" is generally very forthright, in one way or the other, but I cannot determine whether the writer of a letter which appeared in the *Manchester Guardian* recently is for or against. He had seen a picture of Dounreay and, in his own words:

> "I said to myself this is Constantinople and this is a Byzantine church with a minaret beside it. . . . Can it be, however, that the Atomic Energy Authority are lovers of Byzantium. If so, how nice for the future. And what about some nice mosaics?"

"Conventional" power stations have been compared with cathedrals. Why shouldn't nuclear ones look like mosques? And perhaps the addition of mosaics would add but a small percentage to the rather heavy cost.

* * *

A news item from South Africa indicates that tests on "electric shark barriers" are being commenced at St. Lucia Bay, Zululand, this week. To keep my running record on fish and electricity complete I note that a large shark basin has been completed. This measures 100 by 50 yards and is enclosed on three sides.

> "The fourth side is open and the only barrier on this side is electricity. The tests will try to determine whether sharks placed in the basin can escape through the electric barrier."

No details are given of the electrical equipment employed to set up a discharge across the 50 or 100 yards involved.

* * *

Eighty years ago the telephone was a novelty and even a form of entertainment as appears from the following paragraph which was published in the *Electrical Review* of 15th January, 1879:—

> "At a pleasant conversazione, held in the Argyleshire Gathering Hall at Oban, on December 20th last, the telegraph was prominently represented by Mr. McLean, the postmaster of the town. A number of telegraphic appliances were shown at work by Mr. McLean; and the Highland folk had an opportunity of hearing the telephone. Judge of their delight when they found that it could speak 'the gaelic.'"

PERSONAL AND SOCIAL

News of Men and Women of the Industry

Mr. K. A. Robinson, of Lancashire Dynamo Electronic Products, Ltd., was on 1st January promoted within the company to a new appointment as chief engineer. In this position he will be responsible for application engineering aspects of the operations of the company. **Mr. W. F. Hill** has been appointed chief development engineer, taking over the position formerly held by Mr. Robinson.

Mr. E. Forth, B.Sc.(Elec.), M.I.Mech.E., M.Inst.F., generation operation engineer, Central Electricity Generating Board Headquarters, has been appointed chief generation engineer, North Eastern Division. Educated at the Grammar School, Wolsingham, and Kings College, University of Durham, and apprenticed with C. A. Parsons & Co., Ltd., Mr. Forth joined the North Eastern Electric Supply Co. as a student engineer in 1934 and was in the service of that company continuously until the reorganisation of the electricity supply industry in 1948. From 1940 he held successive appointments in the North Tees power station of which latterly he was power station superintendent. At vesting day he became generation engineer (operation) for the Southern Group and subsequently for the Northern Group of the North Eastern Generation Division of the B.E.A., and he became generation operation engineer, Headquarters, in 1957.

Mr. E. Forth

Mr. W. Warren, M.B.E., M.I.Mech.E., M.I.E.E., formerly generation engineer (O), East Midlands Division, C.E.G.B., has been appointed chief generation engineer in the Division in succession to **Mr. O. S. Woods,** who is now divisional controller.

Mr. W. Warren

Mr. Warren served a mechanical engineering apprenticeship with Alley & McLellan, Glasgow. He entered the electricity supply industry by joining the municipal electricity undertaking at Glasgow, and later held positions in the undertakings operated by the North Metropolitan Power Co. (Taylors Lane), and Islington and Hammersmith Borough Councils. He then transferred to International Combustion, Ltd., in whose service he was associated with the commissioning of new plant at Billingham, Derby, Taylors Lane, Ashington, Poplar and St. Pancras. In 1927 he moved to Derby, where he was successively station superintendent and deputy borough engineer. He was appointed generation engineer (operation) of the East Midlands Division in 1948.

Mr. Warren was chairman of the East Midlands Centre of the Institution of Electrical Engineers for 1946-47 and he has been a member of the Institute of Fuel since 1937.

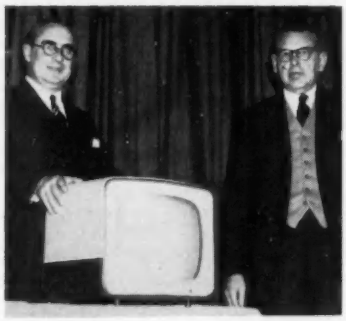
Mr. P. A. F. Fuller has joined Dewhurst & Partner, Ltd., as manager of the components division. Both during and after his service with the R.A.F. Mr. Fuller gained wide experience in his field and recently left Electron (London), Ltd., where he was sales manager, to take up his new position. Mr. Fuller will be responsible for the sales of "Dupar" electric control components as distinct from the control panels, desks, starters and other installation equipment manufactured by the company. He will be based at the head office at Hounslow.

The annual dance of **Dorman & Smith, Ltd.,** was held at the Queens Hall, Preston, on 19th December. This was the first dance to be held by the company since it moved into its new Preston factory. Some 500 guests were present, approximately 300 being members of the staff and the others husbands, wives and friends. Mr. T. Atherton, chairman of the Dorman Smith group of companies, welcomed the assembly.

The Power Plant Division of Elliott Bros. (London), Ltd., which moved early in 1958 to the offices of James Gordon & Co., Ltd., Dalston Gardens, Stanmore, has now been amalgamated with James Gordon & Co., Ltd., and **Mr. R. Hussey,** who for several years was manager of the Power Plant Division, has taken up the position of sales director of James Gordon & Co., Ltd.

To improve the handling of inquiries in the Accumulator Department of Siemens Edison Swan, Ltd., Ponders End, **Mr. F. B. Lee** has been appointed assistant sales manager to Mr. F. Bannister, home and export sales manager.

On 31st December **Mr. N. Dixon,** manager (special technical duties), completed 50 years' service with W. T. Glover & Co., Ltd., and also retired.



Mr. D. T. Hollingsworth, director and general manager, W. T. Glover & Co., Ltd., making a presentation to Mr. N. Dixon on his retirement

He has been presented with a portable television receiver by Mr. D. T. Hollingsworth, director and general manager, to mark his long service. Mr. Dixon has also received a spin dryer from his friends and colleagues.

Mr. A. R. Woodward, B.Sc., A.F.R.Ae.S., has been appointed head of the joining division of the Development Department at Aluminium Laboratories, Ltd., Banbury. He will be responsible for the investigation and development of all methods of joining aluminium with particular reference to welding. Mr. Woodward, who was educated at King Edward VI School, Stourbridge, and Birmingham University, joined Aluminium Laboratories, Ltd., in 1948 as a research investigator and worked for a number of years on the mechanical properties of aluminium, including fatigue.

Mr. A. R. Woodward

Mr. D. G. Ashton Davies has taken up the appointment of sales manager of the instrument division of E.M.I. Electronics, Ltd. He has previously held positions with Marconi Instruments, Ltd., and Mullard, Ltd., and joined E.M.I. from British Physical Laboratories, Ltd., where he has been sales manager for the past two years.

Mr. C. Kramskoy has been appointed chief engineer of the commercial division of E.M.I. Electronics, Ltd. He was previously responsible for the development work on the company's new "Emidec" 2400 computer,

which has been developed in collaboration with the National Research Development Corporation.

Mr. A. W. Field, B.Sc., A.M.I.Mech.E., has been appointed managing director of Mawdsley's, Ltd., of Dursley, Glos., a subsidiary of the Southern Areas Electric Corporation, Ltd., in succession to **Mr. A. H. Topham,** C.B.E., A.M.I.E.E., who, at his own request, is relinquishing his managing directorship of Mawdsley's, but will remain a non-executive director besides acting as a consultant to the board.

Mr. Field was appointed deputy managing director in July last year. He joined Mawdsley's twelve years ago as general works manager, having previously been a management consultant for many years, operating mainly in the engineering industry. He was associated with the founding of the Department of Work Study and Staff Training of the Engineering and Allied Employers' Federation.

Mr. W. G. Holliday, M.I.P.R., M.I.A.M.A., has been appointed group publicity manager of the Lancashire Dynamo group of companies and will be generally responsible for all aspects of publicity and public relations throughout the group. Mr. Holliday began his career with W. S. Crawford, Ltd., served with other advertising agencies and held publicity appointments in various industrial concerns before joining the publicity side of Lancashire Dynamo in 1950. In 1953 he was appointed manager of Lancashire Dynamo Group Publicity Services.

Mr. W. G. Holliday

Mr. S. E. Whorton, London district manager of A.E.I.-Hotpoint, Ltd., has been appointed merchandising manager in the Marketing Department. Mr. Whorton joined Premier Electric Heaters, Ltd., Birmingham (now merged into A.E.I.-Hotpoint) in 1933. Shortly afterwards he became a representative for London and South Eastern England. From 1948 to 1952 he was London manager for Premier, and he was appointed London manager for Hotpoint in 1953.

Mr. S. E. Whorton

Mr. J. A. Barson will succeed Mr. Whorton as London district manager. He joined the Domestic Refrigeration Sales Department at Rugby in 1949 and transferred to the sales office at Peterborough in 1950. Following periods as assistant to district managers in London and Nottingham, he became southern division assistant in July, 1957, and five months later was appointed manager of the south eastern district.

Mr. J. A. Barson

Mr. H. E. Jones, who succeeds Mr. Barson as manager of the south eastern district, joined Premier Electric Heaters, Ltd., in 1937 as assistant to the commercial manager. He was the company's London representative from 1938 to 1940 and, on returning from war service, became personal assistant to Mr. H. Collins, director. He was London manager for Premier from 1952 to 1955 and area sales supervisor for Hotpoint from 1955 to 1958, when he was appointed southern division assistant.

Mr. H. E. Jones

Mr. E. Newbigging, B.Sc.(Econ.), has been appointed sales promotion manager of Parkinson Cowan Appliances, Ltd., Stechford, Birmingham. He was previously sales promotion officer to the Gas Division of Parkinson Cowan Appliances, Ltd.

About 160 members of the staff of the **London Electric Wire Co. & Smiths, Ltd.,** and their guests attended a dinner at the Dorchester, London, on 7th January, to celebrate the fiftieth anniversary of the amalgamation of the London Electric Wire Co., Ltd., and Frederick Smith & Co., Ltd. The toast of the company was proposed by Mr. A. E. Kay, controller of factories, Frederick Smith & Co. The chairman, Mr. E. L. Wildy, in replying, referred to the proposed amalgamation with the A.E.I. Group. Lord Chandos, who was the principal guest, also spoke.

During the evening a specially designed cake was cut by Mr. A. N. Smith, the longest-serving member of the board. A cabaret headed by Edmund Hockridge provided the entertainment.

Mr. H. C. Elsden has been appointed managing director of Ross Courtney & Co., Ltd., in succession to **Mr. J. W. C. Milligan,** who remains on the board. Ross Courtney & Co. is in the Southern Areas Electric Corporation Group, Mr. Milligan being managing director of the parent company.

Mr. N. F. T. Saunders, B.Sc.(Eng.), M.I.E.E., F.C.I.S., has been appointed managing director of Kelvinator, Ltd., Bromborough, Ches., and has resigned from the General Electric Co., Ltd., where he was in charge of overall management of design and manufacture of G.E.C. appliances. After graduating from Glasgow University he joined the Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, and later joined the G.E.C. at Witton as chief designer of f.h.p. motors, fans and motor-driven appliances. In 1934 Mr. Saunders left the G.E.C. to become chief engineer of H.M.V. Household Appliances, Ltd. From there he went to Lancashire Dynamo & Crypto, Willesden, as chief engineer. He rejoined the G.E.C. organisation in 1938 as general manager of Coldair, Ltd. In 1953 he was appointed to co-ordinate the design and manufacture of all G.E.C. appliances and, to facilitate this, founded and subsequently directed the G.E.C. Appliance Design Centre, to which reference is made on p. 118 of this issue. He was appointed to overall management of design and manufacture of all G.E.C. appliances in 1957 and also became responsible for the operation of the subsidiary company, Witton-James, Ltd., which specialises in the manufacture of controls and equipment for printing presses.

Mr. N. F. T. Saunders

Mr. Saunders has been chairman of

Mr. E. L. Wildy's table at the "Lewcos" jubilee dinner

the B.S.I. Committee covering household refrigerators since its inception ten years ago. He is a member of the Council of the British Refrigeration Association and a past-chairman of the Association. He is also a member of the Royal Institution, a member of the Institute of Refrigeration and of the American Society of Refrigerating Engineers.

Kelvinator, Ltd., announces the appointment of **Mr. G. Stenning** as advertising and sales promotion manager on the retirement of **Mrs. E. A. Plummer,** who had completed thirty-four years' service with Hudson Motors, Ltd., and Kelvinator, Ltd. Both companies are associated with the American Motors Corporation, of Detroit. Early in 1958 Mr. Stenning left the Simplex Electric Co., Ltd., where he was advertising and publicity manager of the Creda Division, to join James Sutherland Publicity, Ltd., as public relations director. Before joining Creda in 1955 he was group publicity manager of the Brush Group, Ltd.

Mr. G. Stenning

R. A. Lister & Co., Ltd., announce that **Mr. P. Mackay-James,** director and general manager of their subsidiary company, Blackstone & Co., Ltd., and **Mr. F. E. Blackstone,** a director of Blackstone & Co. and other subsidiary companies, have been appointed to the board of R. A. Lister & Co.

Mr. A. V. J. Wilton, chief purchasing officer of the Siemens Edison Swan Group, was recently presented with a cheque on his retirement by Dr. J. N. Aldington, managing director, on behalf of his many friends and colleagues. Mr. Wilton joined Siemens Bros. at Woolwich in 1913 from an electrical engineering firm at Charlton where he served his apprenticeship, and he subsequently served in the heavy instruments shop and the Layout and Planning Department.

Mr. A. V. J. Wilton

During the 1914-18 war he served with the London Volunteer Rifles. In 1924 he entered the Apparatus and Telephone Purchasing Department, and a year later on the retirement of the late Mr. S. J. Clothier he was placed in charge. When Mr. H. Brown retired from the Cable Purchasing Department in 1940 the two departments were combined to form a central purchasing department, and Mr. Wilton was made purchasing manager for the whole of Siemens, being appointed chief purchasing officer for the Siemens Edison Swan group of companies in 1957. He will continue to serve the company in a consultative capacity for the next twelve months.

The English Electric Co., Ltd., announces that in view of the continuing expansion of the company at home and overseas and of the wider responsibilities now carried by members of the central management, the appointments of the following executives have been re-designated:—**Mr. E. B. Banks,** A.M.I.E.E., is appointed director of commercial policy, contracts and sales; **Mr. P. L. de Laszlo,** O.B.E., is appointed director of corporate affairs; **Mr. W. M. Hurton** becomes director of group manufacturing development; and **Mr. L. H. Short,** M.C., M.I.E.E., M.Inst.T., is appointed director of overseas operations.

Mr. F. W. J. Grinter, who since 1953 has been manager of the Hull depot of the Marconi International Marine Communication Co., Ltd., has been appointed manager, Humber Area. In his new capacity he will be responsible for co-ordinating the work of the Marconi Marine Co. in the ports of the Humber. **Mr. J. W. Dalton,** manager of the company's Grimsby depot, will continue in that capacity to deal with local matters there.

Mr. F. V. Pipe, O.B.E., A.M.I.E.E., who since 1950 has been chairman and managing director of Newton Brothers (Derby), Ltd., has resigned the position of chairman in order to lessen his duties, but continues as managing director. **Mr. Guy Smith,** F.C.A., vice-chairman of the company since July, 1956, has been appointed chairman.

Mr. W. E. Lawman, the inventor of the P.L.P. patent crimping gland, has now sold the patent rights to the Combination Metallic Packing Co. (1928), Ltd., and joined the board of that company as technical sales director, whilst retaining a directorship of P. & L. Products, Ltd.

In the list given in our last issue of electrical men who received recognition in the New Year Honours, we included **Mr. P. C. Ruggles,** B.Sc., a senior engineer with the English Electric Valve Co., Ltd., who was awarded the M.B.E. Mr. Ruggles has been concerned largely with research and development of microwave valves of national importance and it is for this work that the award has been made.

We regret that in the list of awards in our last issue we omitted to include **Mr. G. F. Sills,** M.I.E.E., M.Amer.I.E.E., who has been awarded the M.B.E. From 1917 to 1948 Mr. Sills was at the Manchester branch office of Siemens Brothers and the English Electric Co., during most of which period he was manager. Since

Mr. P. C. Ruggles

Mr. G. F. Sills

1948 he has been working part-time for the English Electric Co.

Mr. H. Etchells, formerly Manchester area superintendent for the A.E.I. Lamp & Lighting Co., Ltd., has been appointed superintendent, Preston area, and **Mr. T. A. Gooch,** formerly Preston area superintendent, is now superintendent, Manchester area. These moves are made in anticipation of the retirement of Mr. Etchells later in the year.

Mr. J. Acton, M.Sc., A.R.I.C., has been appointed new products manager of Midland Silicones, Ltd., and will be responsible for launching and marketing all new silicone, or silicone-containing, products developed by the company. Mr. Acton joined Midland Silicones in 1955 as a technical representative. Latterly he has been in charge of sales in South-East England.

Mr. J. Acton

The annual dinner-dance of the North Metropolitan Branch of the **Electrical Industries Benevolent Association** will be held on 10th April at St. Albans.

Mr. H. J. Barton-Chapple (Rediffusion, Ltd.) was the speaker at last Tuesday's luncheon of the **Electrical Industries Club;** he recalled some of his experiences in the development of television over the past thirty years or so. Sir John Hacking, the president, was in the chair and after moving a vote of thanks to the speaker he announced that the next luncheon would be on 10th February.

Mr. A. A. L. Evans, M.A., LL.B., has been appointed deputy secretary to the North of Scotland Hydro-Electric Board. Before taking up his new appointment Mr. Evans was a depute county clerk of Midlothian.

OBITUARY

Mr. Henry Oswald, M.I.E.E., managing director of British Brown-Boveri, Ltd., died on 8th January after a protracted illness. Mr. Oswald was born in Switzerland in 1902, and received his training with Brown,

Boveri. He was appointed contract engineer with British Brown-Boveri, London, in 1928 and in 1932 was appointed representative and resident engineer in India for the Swiss Brown, Boveri. He became general manager of British Brown-Boveri in 1937, director and general manager in 1941, and subsequently managing director.

Mr. John Shannon, B.Sc., A.M.I.E.E., was drowned when the car he was driving along the South Quays of Dublin fell into the River Liffey on 19th December. Mr. Shannon, who was in his middle forties, was station superintendent at the Eire Electricity Supply Board's Ringsend power station, and he was responding to an emergency call in the early hours of the morning when the accident occurred.

Dr. Hans Sulzer, whose death at the age of eighty-two at Winterthur, Switzerland, we briefly reported in our last issue, was briefly president of the Swiss company of Sulzer Brothers, Ltd., and senior member of the board of Sulzer Bros. (London), Ltd. In addition to his family interests in the engineering field, Dr. Sulzer played a leading part in the industrial and economic life of Switzerland and was well known internationally. His activities embraced banking, insurance and mining, and he served on the boards of several companies. He also played a leading part in the affairs of the Swiss and International Chambers of Commerce and in the field of industrial relations.

The late Dr. Hans Sulzer

During the 1914-18 war Dr. Sulzer represented his country in Washington, and when, after the outbreak of the last war, the economic situation in Switzerland became precarious, he was invited by his Government to lead a mission to London to seek recognition of Switzerland's position as a neutral country and assurances and assistance with regard to essential food and materials.

The funeral service was held at the parish church at Winterthur on 7th January and was followed by cremation.

Mr. H. W. Millatt, Associate I.E.E., district manager at Weston-super-Mare with the South Western Electricity Board since 1949, died on 8th January—a week after his wife—at the age of fifty-eight.

Mr. Millatt received his early technical training with the Westinghouse Brake Co. and with the Brompton and Kensington electricity undertaking. In 1924 he joined the Chester Corporation Electricity Department and was responsible for the inauguration of its commercial section. In 1929 Mr. Millatt entered the service of Bedford Corporation as development engineer and in 1936 he became commercial manager and installation engineer of the Newport (Mon.) electricity undertaking. Before taking up his appointment at Weston-super-Mare he was, from 1940, with the Cornwall Electric Power Co. as district manager for Newquay and North Cornwall.

WILLS

Mr. C. C. Mason, O.B.E., former joint managing director of the Cambridge Instrument Co., Ltd., who died on 9th September last, left £126,143 gross (£123,357 net).

Mr. W. M. Grieve, superintendent of the Oxford power station since 1942, who died on 14th July last, left £5,681 gross (£5,564 net).

Mr. R. W. W. Sanderson, a senior member of the Wembley Research Laboratories of the General Electric Co., Ltd., who died on 11th June last, left £6,082 gross (£5,722 net).

Mr. E. W. Jones, formerly manager of the Central Sub-Area of the South Wales Electricity Board at Cardiff, who died on 4th June last, intestate, left £11,612.

Mr. G. McK. S. Sichel, B.Sc., M.I.E.E., formerly of the Metropolitan-Vickers Electrical Co., Ltd., who died on 20th June last, left estate in Great Britain valued at £7,200 gross (£6,997 net).

Mr. A. Greenhill, for many years an electrical engineer with W. D. & H. O. Wills, Bristol, who died on 24th August last, left £21,622 gross (£21,537 net).

Col. J. Tennant, D.S.O., T.D., D.L., J.P., M.I.Mech.E., former works manager of British Insulated Callender's Cables, Ltd., Prescot, who died on 22nd September last, left £67,595 gross (£66,798 net).

Sir William T. Halcrow, M.I.C.E., M.I.Mech.E., late senior partner in the firm of Sir William Halcrow & Partners, consulting engineers, who died on 31st October last, left £140,538 gross (£133,909 net).

Mr. J. H. Asdell, M.I.E.E., formerly chief electrical engineer to T.I. Group Services, Ltd., and hon. life vice-president of the Birmingham Electric Club, who died on 29th July last, left £6,189 gross (£6,063 net).

Mr. R. W. Gregory, senior partner in R. W. Gregory & Partners, consulting engineers, who died on 10th May last, left £29,138 gross (£24,248 net). Among his bequests he left £100 to the I.E.E. Benevolent Fund.

Mr. J. W. H. Scoggins, member of the Electronics Sales Department, British Thomson-Houston Co., Ltd., Rugby, who died on 16th July last, left £5,997 gross (£5,919 net).

New London Clock

Travellers from the north and elsewhere who use Euston, Kings Cross and St. Pancras stations and the millions who pass along the Euston Road now have a new landmark. It is the 12ft diameter face of a new and imposing illuminated clock, 110ft above street level, surmounting the eight-storey Babcock House, the London headquarters of Babcock & Wilcox, Ltd.

It is neon-lit and "contemporary" in style, its white hands contrasting with hour motifs in glowing red. The clock is associated with a large blue neon-lit sign, "Babcock," in Franco "Lumina" letters with blue "Perspex" faces and metal returns, arranged vertically on the end of the building. The visual design for the clock face and name display was produced by the company's Publicity Department, and the manufacture and installation were carried out by the Franco-British Electrical Co., Ltd. (Franco Signs). The clock has been erected within the lift tower on top of the building, and is operated by a weight-driven electrically-wound tower type clock movement, mounted on a rigid steel stand with interconnecting couplings and precision-bevelled gears. It is fitted with a reserve mechanism giving approximately five hours' full operation in the event of an electricity supply cut.

Night photograph of the new B & W clock

Restrictive Trading Agreements

The Registrar of Restrictive Trading Agreements has issued a statistical summary of the work of his office up to the end of 1958. At that time 2,100 agreements had been registered and during 1957 and 1958 the parties to over 140 of them were told that it was intended to refer their agreements to the Restrictive Practices Court. In 55 of these cases the Registrar has been informed that the agreements have either been abandoned or so altered as to remove all registrable restrictions. Similar steps have been taken in respect of about 14 further agreements.

Proceedings have been instituted in over 50 cases. Two cases were heard by the Court in 1958 and dates were fixed for the hearing of seven more during the earlier half of this year, including agreements made by the Radio Valve Manufacturers' Association (7th April), the Water Tube Boilermakers' Association (27th April) and the Associated Manufacturers of Domestic Electric Cookers (22nd June).

Engineering in Europe

ABSTRACTS FROM FOREIGN TECHNICAL JOURNALS

THE character of the breakdown of plastic-bonded paper insulation used in capacitors, capacitor bushings and cable terminal boxes (potheads, etc.) differs from that of the breakdown of impregnated paper insulation, say, cable paper, in that it is mostly an electrical breakdown by contrast with the thermal breakdown in the latter case. Although both are initiated by ionisation processes and predischarges, the mechanisms of these two forms of breakdown do not otherwise seem to have much in common. The rate of deterioration of the two types of insulation, i.e. their service life, is also different.

Investigations on dielectric strength for capacitor insulation must, above all, be experimental and use statistical methods in the evaluation of the results with a view to predetermining the useful life of such an insulation. Among the general conclusions drawn from the results of comprehensive tests it is interesting to find that the relationships (though not analytically expressible so far) are different in different ranges. What seems to be well established is that complete breakdown occurs when the total loss of energy by ionisation under the critical voltage stress reaches a certain value. Inferences can therefore be drawn on the effects of test and operating voltages, for example, on the service life of hard-paper condenser bushings.—" Electric Ageing Characteristics of Plastic-Bonded Paper H.V. Insulation with Capacitor Electrodes," J. Artbauer, *Elektrotech. Obzor*, Vol. 47, No. 10, pp. 515-523, October, 1958, in Slovakian.

Mass Impregnated Cables

The breakdown mechanism of cable insulation initiated by, or due to, ionisation phenomena on the conductor surface represents a problem that can be solved only by methods combining consideration of the geometrical properties of the spaces between wires and insulation with consideration of the characteristics of the insulation used. The first part, viz. the electrostatic problem, was solved for a very much simplified case by Levi-Civita in 1905 (by expansion of a hypergeometric series), but its application is severely limited.

The author has succeeded in developing on this theoretical basis a method of practical usefulness on the permissible assumption that the concave spaces between adjacent wires and insulation are free of impregnating compound. The physical part of the problem, i.e. the phenomena leading to discharges in the insulation, is solved by consideration of the thermal and pressure conditions in the insulation. This furnishes the inception voltage of ionisation as a function of the operating voltage, and the position of ionisation tracks at the inside of the insulation relative to the wires. Experimental results confirm the accuracy of the predictions.—" Electrical Stress at the Conductor Surface and Internal Corona Inception Voltage of a Mass-Impregnated Cable," M. Marsal, *Elektrotech. Obzor*, Vol. 47, No. 10, pp. 491-497, October, 1958, in Czech.

D.C. Circuit Breaking

Magnetic deflection of partial arcs in narrow slots in a high-flux magnetic field results in a rapid drawing-out of the arc and increase of the arc voltage. Basic investigations were carried out on re-ignitions of the arc, speed of migration of its parts, field strength of the arc and the time curve of the arc voltage. The knowledge gained resulted in the design of d.c. circuit-breakers by which a much more rapid clearance of the currents is achieved.

In the range investigated, i.e. up to 12 kA, voltage gradients up to 1,500 V/msec at arc speeds of more than 300 msec were reached. Short-circuit currents in d.c. systems of up to 1 kV are thereby limited within less than 1 msec after contact separation. The arc voltage may by simple means be limited to permissible values, so that surges, easily set up when disconnecting inductive d.c. circuits, can be avoided with safety.—" High-Speed D.C. Circuit Breaking," H. Wegesin, *ETZ-A*, Vol. 79, No. 21, pp. 808-813, 1st November, 1958, in German.

Screening of Communication Cables

The introduction of 110 kV cables into town distribution makes it essential to protect telephone and signalling cables led through the same cable trenches as the power cables. The usual protective gaps with barium for telephone cable protection cannot be used, because of the large numbers of such gaps which would be required. Instead of these spark gaps, the authors of the article recommend a simple steel rail or band to be put down below the cable to be protected, preferably of a cross-section of $40\times4-40\times5$ mm.

Calculations show that the e.m.f. in the telephone or signalling cable is reduced to about five per cent of the dangerous value obtaining otherwise, viz. to 900 V, which corresponds to about 60 per cent of the test voltage for which the cables are tested when laid down. The protecting bands should have maximum perimeter for the given cross-section, maximum permittivity and minimum resistivity and a cross-section corresponding to the equivalent section of a copper screen.—" Screening of Communication Cables Against Dangerous Effects of 110 kV Cables," V. N. Ivanov and V. V. Kulikov, *Elekt. Stantsii.*, No. 9, pp. 40-43, 1958, in Russian.

Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates.—Editors, *Electrical Review*.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	.. .. ..	ton	£180 0s 0d
COPPER, H.C. Electro	.. .. ..	ton	£226 10s 0d
Fire Refined 99·70%	.. .. ..	ton	£225 0s 0d
Fire Refined 99·50%	.. .. ..	ton	£224 0s 0d
COPPER Tubes	.. ..	lb	2s 2d
Sheet	.. ..	ton	£258 0s 0d
H.C. wire and strip	.. .. ..	ton	£275 5s 0d
LEAD, English	.. ..	ton	£72 15s 0d
Foreign	.. ..	ton	£71 0s 0d
MERCURY	.. ..	flask	£74 0s 0d
TIN, block (English)	.. .. ..	ton	£758 10s 0d
ZINC, G.O.B. Foreign	.. .. ..	ton	£76 0s 0d
BRASS Tubes (solid drawn)	.. ..	lb	1s 11¾d
Wire	.. ..	lb	2s 7¾d
PHOSPHOR BRONZE Wire	.. ..	lb	4s 1¼d
PLATINUM	.. ..	oz	£19 10s 0d
RUBBER, No. 1 R.S.S. spot	.. ..	lb	25d—25½d

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Building Construction and Space Heating

MAY I congratulate both you and your contributor (Mr. R. D. Jackson) on the recent series of articles on floor warming. I am sure that many of your readers would welcome a composite reprint of the series, if this could be made available.

Referring to the letter by Mr. Lomax on the above subject in your issue of 9th January, I would like to support his statement that economical whole-house heating is dependent on suitable structural design, and that floor warming, at least for domestic use, is best suited to background heating, leaving the "topping-up" to be done, as required, by local appliances. His reference to the capital cost of such a system being comparable to the cost of fired central heating is unfortunate, however, as one of the drawbacks to fired central heating is its capital cost, which puts it outside the reach of the average householder.

The capital costs of the all-electric house must be kept competitive with those of the average house if full advantage is to be taken of future opportunities for electric heating. The trend of generating costs and the increasing disadvantages of solid fuel have given the industry the opportunity to make electric heating the heating of the future—if architects and building designers in general can be persuaded to accept the need for suitable construction.

According to Mr. Lomax, double glazing is essential to comfort and economy. I contend that unless the climate is severe and the winter season prolonged, its present cost cannot be justified, if cost is a prime consideration. The mid-winter day is short and the period when the comfort consideration is most important is after dark, when heavy curtains can successfully defeat the radiation loss mentioned by Mr. Lomax.

Buckfast, S. Devon. R. I. ELLARBY, A.M.I.E.E.

Pie Carts and Hydatids

I NOTICE that "Reflector" is puzzled over the meaning of (*a*) "pie carts" and (*b*) "hydatid cookers" (*Electrical Review*, 14th November, 1958) and therefore offer some enlightenment.

Pie carts are fairly common in New Zealand towns. Being nocturnal in their habits, they appear on the streets after dark and are gone again before daybreak, actually from about 6 p.m. to midnight, or later. Their function is to provide coffee, pies and potatoes, sausages, etc., to those requiring them. They are not actually carts in these modern times, but are four-wheeled covered trailers which are drawn up to the kerb where patrons, sheltered by the hinged sides, which are raised to form roofs, may eat while standing at a long counter.

Electricity for their stoves and urns is drawn from permanent outlets on suitably situated power poles, the carts being licensed by the local authority. Power is metered at a switchboard in the pie cart, or on the power pole.

The argument noted by you is whether a pie cart is a "portable appliance" or not, as upon the definition depends the application of certain wiring regulations.

Offal cookers for hydatids are electrically heated urns in which offal intended for dog food is first sterilised by heating. New Zealand farmers generally feed their working dogs on sheep or other offal and as raw offal is a fruitful source of hydatids which dogs transmit to humans, and which reduce the value of meat for sale, there is at present a nation-wide campaign to eradicate the disease.

Various "offal cookers" have appeared on the market, and some of these, by virtue of their shoddy design, appear to be more likely to cook their operators.

Opunake, N.Z. I. M. PAGE,
Engineer,
Opunake Electric Power Board.

Factory Clock Systems

I HAVE read Mr. A. Agar Clery's very excellent article on "Factory Installations" in the *Electrical Review* dated 2nd January with great interest and I am sure that a factory so equipped would be extremely efficient, but why dismiss so important a part of any factory installation as the clock system with only one word? Surely the whole running and co-ordination of every department in the factory depends on a good clock system. Wages, job costing, process timing, automatic sound signals, staff attendance, and even "Music while you work," are all tied up with the clocks. Any factory so well equipped as Mr. Agar Clery would have it, should also have an impulse clock system to match the rest of the electrical equipment.

It does seem to be the tendency today for architects and others concerned with building and equipping factories and other buildings to forget the need for clocks until the job is well under way; then there is a rush to find suitable clocks. Insufficient time and thought is given to so important a part of the equipment.

London, E.C.1. F. STEVENS,
Technical Manager,
"Gibson" Clock Division,
Baume & Co., Ltd.

Engineers' Guild

THE report for the twelve months to 30th September which was presented at the annual meeting of the Engineers' Guild last month at the Grosvenor Hotel, Victoria, London, S.W.1, records a total membership of 4,613 (hon. members 2, members 3,604 and associates 1,007), a net decrease of eight during the period.

Reference is made in the report to the survey of professional remuneration which, it is said, has secured a response rate of 75 per cent from the almost 10,000 people approached. The Guild's pension scheme is mentioned; so far 80 policies have been issued. Contact has been made with the British Transport Commission upon a number of subjects affecting professional engineers in this field.

During the period the Guild's scope was widened to include members of the Institution of Chemical Engineers. The activities of the home branches and the overseas regional associations and correspondents are referred to. The accounts show an income of £11,548 and a surplus of £87.

Hunter Memorial Lecture

THE first P. V. Hunter Memorial Lecture was delivered by Mr. C. O. Boyse, B.Sc.(Eng.), M.I.E.E., to the Institution of Electrical Engineers on 8th January.

After contrasting present conditions with those existing in the field of electricity in 1883, when the late Mr. P. V. Hunter was born, Mr. Boyse referred to Hunter's early admiration and affection for Sebastian de Ferranti, who inspired him to become an electrical engineer. He had first been employed by Messrs. Merz & McLellan in Newcastle, in 1904, when Cargill power station, the first large exploitation of Parsons' revolutionary steam turbine, had been only partially completed. After Price left the firm in 1909, Hunter set to work to develop a more discriminatory protective system than the Merz-Price. The outcome was the Merz-Hunter split-conductor system, patented in 1911. In the first world war, Hunter had been the engineer attached to the team whose efforts had produced the now famous Asdic equipment. In 1919, he had joined Callender's Cable & Construction Co. At that time there had been a general reluctance to produce 33 kV three-phase cables (in spite of a pressing demand) because of their assumed inherent instability. Hunter's reaction had been to concentrate on an improvement in the quality of materials and production methods. During this time, the Callender-Hunter protection system had been developed.

Between the wars, Hunter had established himself as one of the great cable engineers. His greatest contribution to the development of power cables had been his championship of the direct gas pressure type.

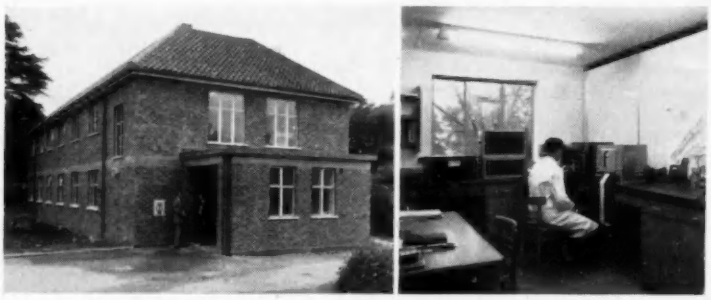
In the second world war, his engineering genius was soon called upon, in the search for protection against the magnetic mine. Cables designed to be towed had proved inadequate, because the strength of the magnetic field created by any normal cable that could be made buoyant was a mere fraction of what was needed. These difficulties were overcome by Hunter who conceived a cable of an entirely new kind, in which the conductor, instead of being in the centre, was situated around the periphery, in the form of a thin annulus of wires, the entire centre being composed of buoyant material.

Mr. Boyse went on to refer to the present situation and future prospects of electrical engineering. He said it had now become accepted that high-voltage d.c. transmission had important advantages over a.c. transmission, but it required expensive terminal equipment.

NEW S.I.R.A. LABORATORIES

A NEW laboratory block was officially opened last week by Professor N. F. Mott (Cavendish Professor of Physics in the University of Cambridge) at the British Scientific Instrument Research Association establishment at Chislehurst. The building is of two-storey construction with a working area of 3,000 sq ft, and accommodates the optical and electronics departments.

In addition to the normal 240 V a.c. supplies, auxiliary services to special type sockets are provided from a distribution centre at one end of the building; for example, 250 V d.c. from a battery, 24 V 25 A d.c. from a motor generator and 400 c/s a.c. from an alternator. A concentric cable broken every 10ft but provided with U-links enables high frequency or pulse signals to be transmitted between any laboratories. Service ducts run from the walls to the cenre of each unit of space to supply island benches or free-standing apparatus.



New S.I.R.A. laboratories at Chislehurst and (right) the nucleonics laboratory

A new single-storey dining room has been built at the establishment. This room is also intended for the meetings held in connection with the Association's work.

After the opening ceremony a number of demonstrations of current research work were given by the staff. In the electrotechnology laboratory a system of determining the thickness of lead sheathing on power cables has been investigated. A neutron detector using glass scintillators was demonstrated in the nucleonics laboratory and ultrasonic flow-meters were shown in the electronics laboratory.

A position-sensitive detector using an OC71 photo-transistor was demonstrated in the electro-optics laboratory. The lateral sensitivity of this instrument is about 1 μin and its applications include machine tool controllers, galvanometer amplifiers, vibration measurement, liquid level controllers, etc.

At a lunch following the opening ceremony, the loyal toast was proposed by the chairman, Mr. J. E. C. Bailey. Professor Mott, who proposed the toast of the Association, said that it was appropriate that he had come from the laboratory where the electron was first discovered to open this new extension of S.I.R.A. He was well aware of the debt that fundamental research owed to the instrument makers. In reply the director, Dr. J. Thomson, said it was hoped that S.I.R.A. would be completely independent of the D.S.I.R., but this could not occur before 1964. He concluded by thanking the subscribers to the building fund.

The new laboratory block was designed by Dr. A. J. Maddock, deputy director. The architect was Mr. G. T. Harman and the main contractors were Thomas Cutler & Sons, Ltd. The electrical installation was carried out by P. T. Hewstone & Co.

FUTURE OF THE CONVENTION

It is persistently rumoured that the Council of the British Electrical Power Convention is definitely in favour of the idea that the Convention shall be held every other year instead of annually. If this is so it is to be regretted. Any decision in this matter is, of course, subject to confirmation by the delegates to the Convention at an annual general meeting under the constitution of the Convention.

Automobile Electrical Equipment

By
A. N. PARTRIDGE*

Major items of electrical equipment employed in British private cars are surveyed, with occasional reference to other classes of vehicles where it is necessary to draw a comparison or illustrate a trend. Modern practice has tended towards standardisation of components

THE considerable degree of standardisation, particularly of underbonnet items, achieved in recent years has led to a substantial reduction in the number of different models and types of electrical components to be found in British cars. This, with the general adoption of a 12 V system, has facilitated large-scale production to meet the expanding requirements of the British motor industry.

Batteries for car use are of conventional lead-acid type and usually have 7, 9 or 11 plates per cell, with 10-hr rate capacities of the order of 38, 51 and 64 ampere-hours respectively. Developments which have taken place over the past few years include the cleaning up of the battery top by partially or wholly concealing the intercell connecting links; the introduction of improved types of cable connectors which have practically eliminated the corrosion troubles to which batteries were once so prone; and the use of highly porous rubber and other materials for inter-plate separators, replacing the cedar wood employed hitherto for this purpose. The battery illustrated in Fig. 1 is the latest Lucas development in which the separate filler caps have been replaced by a single moulded venting system.

The battery charging requirements of most modern British cars are met by two sizes of d.c. generator, one of 3·9in yoke diameter and $8\frac{7}{8}$in overall length having an output of 260 W and weighing 13 lb, the other of 4·5in yoke diameter and $10\frac{3}{16}$in overall length with an output of 300 W and weighing 19 lb. The general construction is shown in Fig. 2. Both are two-pole, two-brush shunt-wound machines, the armature being carried in a ball bearing at the drive end and a porous oil-impregnated bush at the commutator end. The machines are of the ventilated pattern, a fan on the driving shaft drawing cooling air through holes in the end covers. (For use in more exposed service conditions, such as on agricultural tractors, the same generators in non-ventilated form give outputs of 150 and 175 W respectively.) The generator is belt-driven from the engine, the drive ratio being such that the maximum output speed is attained at a road speed not exceeding 20 m.p.h. in top gear, subject to a maximum safe speed of rotation of 8,500 generator r.p.m.

An electromagnetic relay connects the generator to the battery when the speed is such that the generated voltage exceeds that of the battery and, conversely, disconnects the units when the battery voltage is the greater, so preventing the battery from discharging through the generator windings. This cut-out carries two windings, a shunt winding directly across the generator output terminals and a series winding in the charging circuit. As the generator voltage rises with speed, a value is reached at which shunt coil electromagnetism causes the relay to operate and so close a pair of contacts in the charging circuit. Current now flows from generator to battery through the series winding, and the added electromagnetic effect assists in holding the relay closed against vibration. When, due to falling speed, the generator terminal voltage falls below that of the battery, the direction of current through the series winding reverses, and the differential action between the two windings assists in causing the relay to open. It is normally mounted on a common base with the regulator (Fig. 3).

Compensated Voltage Control

Obviously, some form of regulation of generator output is essential. The compensated voltage system of control, shown in Fig. 4, has been in general use on the majority of cars and motor cycles since 1936, and for considerably longer on commercial vehicles. A vibrating-armature voltage regulator (operating at 40-50 c/s) controls the insertion into the generator field circuit of a limiting resistance, the period of insertion per cycle of vibration increasing with generator speed. In this way, the mean value of the generated voltage is maintained within predetermined limits at all speeds above the regulating point, the generator output being determined by the potential difference between generator and battery. Series-compensating turns on the regulator winding limit generator

* Joseph Lucas, Ltd.

Fig. 1.—Modern 12 V battery

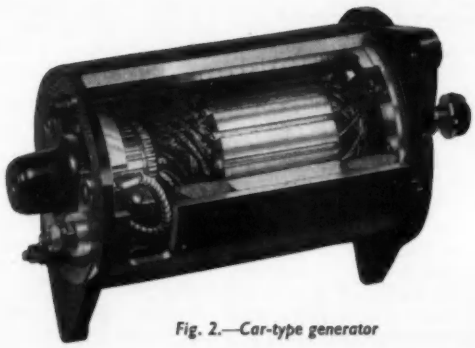


Fig. 2.—Car-type generator

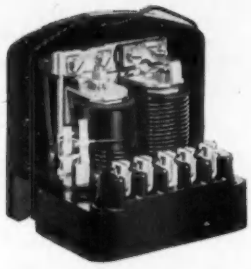


Fig. 3.—Control box, combining compensated-voltage regulator (left) and cut-out relay (right)

output under heavy load conditions: for example, if the battery is discharged and the lights are in use, the current flowing through the compensating windings causes the regulator to operate at a reduced voltage, so reducing the potential difference between generator and battery and limiting the current to a safe value. With such a system, therefore, a high output is given to a discharged battery, reducing to a lower value as the battery becomes charged, and protection against generator overloading is provided.

Many such regulators incorporate a bimetal temperature compensator, which both offsets the ohmic resistance rise during normal operation and also causes the operating voltage setting to increase in cold weather and decrease in hot weather to meet the accompanying variations in battery internal resistance. This is achieved by adjustment of the armature spring tension.

Current-Voltage Control

The compensated voltage control system, while being to some extent a compromise, has worked extremely satisfactorily for the electrical loadings of most British cars up to the present time. As electrical loads increase, however, the necessity arises for increased generator output and more efficient use of that output. Under these higher-load conditions, a regulator of greater sensitivity to load changes becomes necessary. The solution is known as current-voltage control and is to be found in many passenger service vehicles and certain cars, particularly those with higher-output generators than the two standard models described.

This system employs two regulators with vibrating contacts in series in the field circuit, one being shunt wound and responsive only to voltage, the other series wound and responsive only to current (Fig. 5). As generator speed is increased the terminal voltage rises, the field being energised through the normally closed contacts of the two regulators; at a predetermined value (about 13 V) the cut-out relay closes to connect the generator to the battery. Further increase in speed raises the terminal voltage until, assuming first conditions of charged battery with no load or only light load, the operating setting of the voltage regulator is reached. The armature is set into vibration, inserting the field resistance in the manner described above and similarly producing a generator output proportional to the potential difference between generator and battery.

If, because of a discharged battery, a heavy electrical loading or a combination of both, the generated voltage does not rise to the voltage regulator operating setting, the output current is kept within safe limits by the current regulator. When the current flowing through the current regulator winding reaches the maximum rated output for the particular size of machine, the current regulator armature is set into vibration, again inserting the resistance into the field circuit and preventing the current from exceeding the maximum safe value. As the battery becomes charged and the voltage of the system rises, a point will be reached at which the voltage regulator commences to operate, causing the current to fall and the current regulator to become inoperative (Fig. 6).

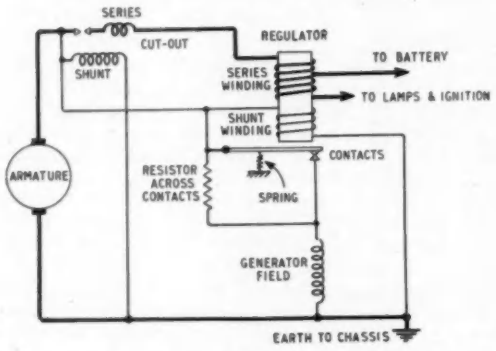


Fig. 4.—Diagram of compensated-voltage control charging circuit

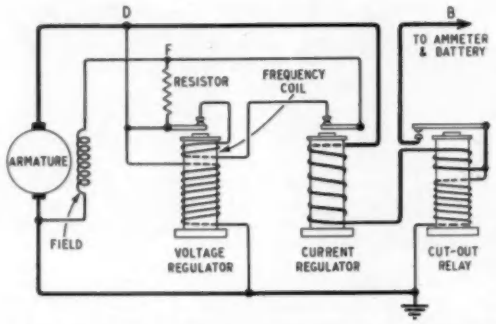


Fig. 5.—Diagram of current-voltage control charging circuit

A.C. Generators

Permanent magnet alternators are fully established on many motor cycles, and are being incorporated in all new designs, having proved advantageous for this form of service. Rectification is achieved by a selenium full-wave bridge rectifier. On passenger service vehicles, with heavy interior lighting loads requiring generator capacity of the order of 100 A, alternators become an attractive alternative proposition to overcome commutation difficulties.

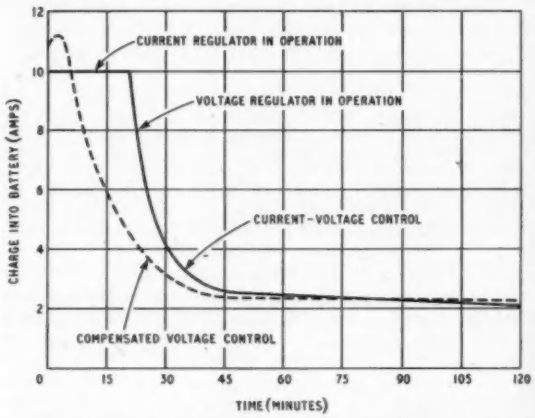


Fig. 6.—Comparison of compensated-voltage and current-voltage control of generator output, commencing with half-discharged battery and lighting load on

Also, since they can be driven at higher speeds than the d.c. machine, smaller units can be constructed for the same output. A number of such vehicles in service are so equipped.

Present car requirements can be met more economically with the d.c. systems described. The anticipated need for increasing outputs within the next few years, possibly up to 50 A, may modify this position.

Starter Motor

The starting needs of practically all British cars are fulfilled by three sizes of electric motor, with yoke

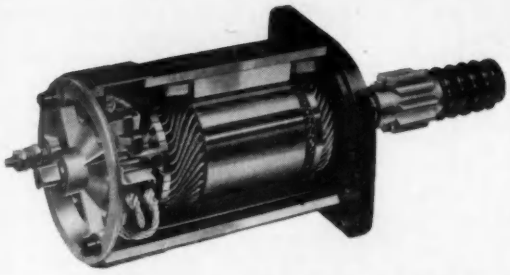


Fig. 7.—Starter motor with inertia-type drive mechanism

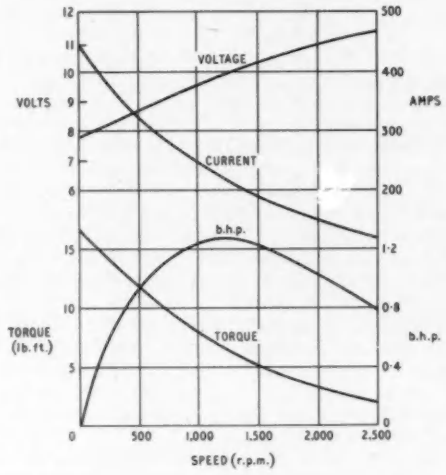


Fig. 8.—Performance characteristics of starter motor

diameters of 3½, 4⅛ and 4½in and approximate weights of 12, 18 and 21 lb respectively. All are four-pole four-brush machines with series field connections, and their construction, shown in Fig. 7, is similar. Field and armature windings are of copper strip to handle the considerable operating current. The armature is usually carried in oil-impregnated bearing bushes housed in the end brackets. Mounting to the engine is through fixing holes in a flange on the drive end bracket. An extension of the armature shaft carries the gearing mechanism which couples the starter motor to the engine flywheel.

The performance characteristics of the intermediate size of starter motor are illustrated in Fig. 8. Under lock conditions (corresponding to turning an engine from rest) it exerts a torque of about 17 lb-ft with a consumption of some 450 A. Maximum power output of the order of 1¼ b.h.p. is developed at about 1,200 r.p.m. at which speed the torque is 7 lb-ft and the current 220 A.

Since an engine speed of about 100 r.p.m. is required, a gear ratio of the order of 12 : 1 between motor and flywheel is necessary, and the motor must be disengaged from the flywheel once the engine is running.

In various forms, the inertia type drive mechanism has an almost universal application in the major field we are considering. In a typical example (Fig. 7) an internally-threaded pinion runs on a screwed sleeve which itself is splined internally to the armature shaft. As the starter accelerates, the inertia of the pinion causes it to twist along the screwed sleeve into engagement with the flywheel, the shock of engagement being cushioned by a heavy compression spring. When the engine starts to

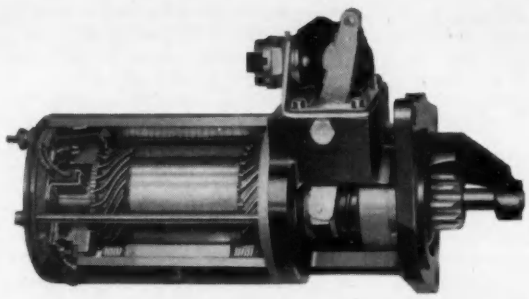


Fig. 9.—Starter motor with pre-engaged drive mechanism

run under its own power, the pinion over-runs the armature shaft and so screws itself back out of engagement.

The pre-engaged type of drive mechanism is intended mainly for use where premature pinion ejection with the inertia drive may arise. The pre-engaged mechanism allows the pinion to be moved into mesh with the flywheel before the starter motor is energised, and to be so maintained until the engine runs. Pinion movement is achieved either electrically by a solenoid and forked lever, or mechanically through linkages; the switch contacts are arranged to close at the completion of pinion travel (Fig. 9). An over-running clutch allows the pinion to slip on the armature shaft after the engine has fired and before the engagement mechanism has been released, so preventing the motor being driven by the engine. This type of mechanism will be found on many designs of diesel engines, which present rather different starting problems from the petrol engine.

Ignition Equipment

The function of the ignition equipment is to produce electrical discharges at each sparking plug in turn at a frequency dependent upon engine speed. For example, a six-cylinder engine running at 5,000 r.p.m. requires 250 sparks per sec, each of which must be timed in relation to its successor with extreme accuracy, but whose timing in relation to the crankshaft can be advanced or retarded according to engine speed and load. The voltage necessary to initiate the discharge may be 15 kV or even higher, depending upon the gap between the plug electrodes, and the degree of compression of the fuel-air mixture.

All private cars and most petrol-engined commercial vehicles employ a battery-coil ignition system, in which an engine-driven contact breaker controls the flow of current through the primary winding of an induction coil. The circuit is illustrated in Fig. 10. The collapse of current in this winding each time the contacts separate causes a high voltage to be induced in the secondary winding of the coil, which at that instant is connected through a high-tension distributor to the appropriate sparking plug. Spark timing is varied automatically by control of the instant of contact separation.

A typical 12 V coil has a secondary winding of about 20,000 turns of 44 s.w.g. enamel-covered copper wire in 30 layers, each paper-insulated from its neighbour. The primary winding, wound over the secondary, consists of some 360 turns of 25½ s.w.g. wire in three layers, the whole being carried on a laminated iron core. This assembly is enclosed in an iron sheath, placed between an insulating base and a moulded high-tension terminal cover, and housed in a container filled with an insulating compound, usually a light oil.

The contact breaker and h.t. distributor are housed,

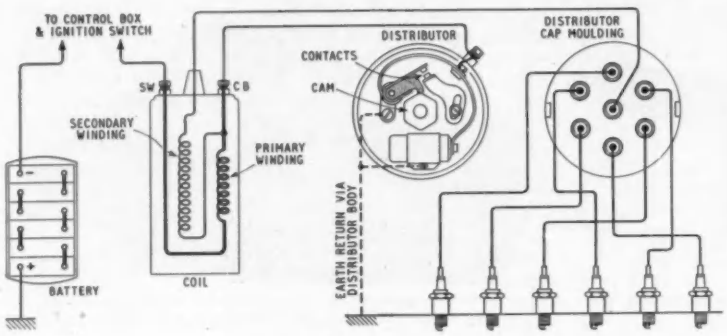


Fig. 10.—Circuit diagram of a six-cylinder coil ignition system

with the timing control devices, in a composite unit of which a typical example is illustrated in Fig. 11. The diecast body has a steel shank in which an oil-impregnated bush forms the bearing for a hardened-steel drive shaft. The upper end of this shaft drives a hardened-steel cam having as many lobes as the engine has cylinders, the cam contour being controlled to give the designed opening and closing rates and periods. The lower end of the shaft is coupled to a half-engine-speed drive. The cam actuates a bakelised-fabric heel attached to the moving member of a pair of tungsten contacts, normally held closed by a stainless steel tensioning spring. A 0·2 μF capacitor is connected across the contacts.

A moulded rotor carrying a brass electrode is attached to the drive shaft above the cam, and this electrode is in electrical connection with the ignition coil secondary winding through a cable and rubbing carbon brush contact. As the shaft rotates, the end of the electrode passes very close to fixed electrodes in the cover moulding connected to the sparking plugs by rubber-insulated cables. At the instant of voltage induction, the rotor electrode is adjacent to the appropriate fixed electrode, and a jump spark occurs to complete the circuit to the plug.

The need for spark timing variation arises from two factors. First, as engine speed increases, the piston travels farther during the time taken for the mixture to burn; thus for combustion to be completed shortly after the piston reaches the top of the compression stroke, the spark must occur progressively earlier with rising engine speed. Secondly, the rate at which the mixture burns is a function of its density, which in turn is a function of load, and is more rapid under full than part throttle conditions. The ignition point thus requires advancing under light load conditions to enable combustion to be completed.

The speed-sensing control is a centrifugal flyweight mechanism in which two pivoted weights move outwards as engine speed increases, against the tension of two control springs which determine the actual rate and degree of advance. The cam foot is linked to these weights so that their outward movement advances the cam in relation to the driving shaft; thus the contacts are separated rather earlier, and the spark timing is advanced relative to the piston position.

The load-sensing control is achieved through a flexible diaphragm, one side of which is subjected to induction pipe depression, and the other side linked to the plate which carries the contact breaker. With a light load, the depression is of a high order; on full load it is of low value. Deflection of the diaphragm, against the tension of a control spring, causes the contact breaker plate to move in a direction opposite to that of cam rotation, so that the ignition point is advanced at part-throttle openings.

Lighting

Vehicle headlamps are required to give a long-range beam for early warning of obstacles with, at the same time, good local dispersion of light to enable the vehicle to be positioned on the road. A long-range beam, however, acts as a source of severe dazzle to an oncoming driver. A "dipped" beam is therefore required which will still provide adequate illumination to allow reasonable speed to be maintained with safety.

In the headlamp in current use on practically all cars, commercial vehicles and motor cycles (Fig. 12) the reflector and front lens form a composite assembly known as a "light unit," the reflecting surface being produced by the deposition of a thin coating of aluminium under vacuum. A prefocus type double-filament bulb is employed and a flange, soldered on to the bulb cap after manufacture, locates in the bulb holder to give very accurate positioning of the filaments with respect to the focal point of the reflector. An adaptor, with spring-loaded contacts, secures the bulb in position, and the light unit is then virtually proof against the entry of dust or moisture.

The light unit is carried on a seating rim in which three keyhole slots are provided. These slots register under the heads of spring-loaded screws in the lamp body, by means of which the aim of the beam can be adjusted. A decorative front rim and rubber dust-excluding ring are placed over the seating rim.

One filament, of 50 W rating, set precisely at the focal point of the reflector, produces the main driving beam. The second filament, of 40 W rating, is above and offset from the first, and is used to produce the meeting or dipped beam. The moulded front lens has a series of small flutes and prisms of known characteristics formed on its surface; since the bulb is permanently correctly focused, the distribution of intensity within the light beam from the lamp conforms to a carefully predetermined pattern.

To obtain driving and meeting beams from a single lamp means that both must to some degree be compromised. It is therefore of interest to note that a "four-headlamp" system has recently been introduced on many American motor cars. In this system, two of the headlamps are designed solely to produce the most effective

Fig. 11.—Typical four-cylinder distributor unit

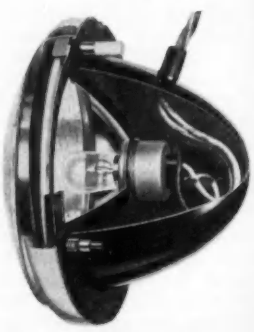


Fig. 12.—Modern headlamp

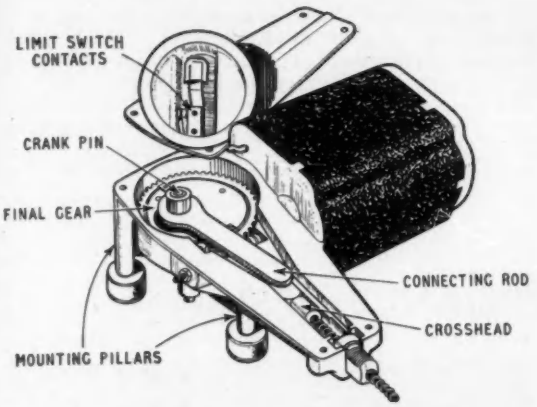


Fig. 13.—Motor and gearbox of a cable rack windscreen wiper

main driving beam, and the other two purely for the best practical meeting beam.

In the United Kingdom, the legal requirement regarding lighting is met by the provision of two white lights showing to the front and two red lights to the rear, of specified size, wattage and mounting positions, together with illumination of the rear number plate. Usually, combined with each rear lamp, and employing the higher-wattage filament of a double-filament 6/21 W bulb, is a braking indication lamp controlled by a switch in the braking system, either mechanically or hydraulically operated.

Also, often combined with the side and rear lamps are those lamps used for direction indicating; many systems make use of the braking indicator filaments at the rear for this purpose. Future legislation will call for the fitting of separate lamps at the rear, and possibly also the front, for direction indication.

Electric Horns

There are two categories of electric horns, impact and non-impact types. In the former, a diaphragm of corrugated sheet metal is held rigidly around its circumference, its centre being fixed to a soft iron armature. In front of the diaphragm, and also secured to the armature, is a metal tone disc whose outer edge is free. Beneath the armature is an electromagnet fed through a normally-closed contact breaker. When the horn push is pressed, the electromagnet is energised and the armature is attracted to it, impacting on the magnet core; its movement separates the contacts, for the cycle to be repeated at a frequency determined by the diaphragm characteristics. The impacting of the armature causes the diaphragm and tone disc to be set into vibration to produce the note characteristic of this " high frequency " horn.

In the second category, a somewhat similar arrangement of armature and electromagnet is employed, but in this case the armature does not impact on the magnet face. Vibration of the diaphragm sets an air column into resonance, producing a note in a manner similar to an orchestral wind instrument. The pitch of the note is determined entirely by the length of the air column, and such horns are usually known as the " windtone " type.

Windscreen Wipers

The wiper currently fitted to most British cars has a small electric motor mounted on the engine side of the bulkhead and transmitting a push-pull motion through a flexible cable rack to toothed wheels on the wiper arm spindles. The rack is made up of a steel core carrying a wire helix, and runs through lengths of rigid outer casing fitted between the motor gearbox and the two wheelboxes. Rotary motion of the motor armature is converted to the reciprocating movement of the rack by means of a single-stage worm and reduction gear to which the rack is coupled through a connecting rod and crosshead (Fig. 13).

In some instances, two-speed operation is provided by the insertion of a resistance in series with the motor field coil to give a higher rate of wiping. Various devices enable the arms and blades to be automatically parked in an unobtrusive position when not in use.

As a protective measure against damage through overloading, e.g. by snow or ice, a thermostatic circuit-breaker is often employed to isolate the motor from the supply. The current consumption of such a wiper motor is of the order of 3·5 A at 12 V.

Direction Indicators

The semaphore indicator, in which a solenoid is energised to raise a hinged illuminated arm, is still in common use, but now the flashing light system is initially fitted. Such a system is controlled by an electro-thermal switch, which depends for its operation on the heating and contraction of a length of wire, and is illustrated in Fig. 14. Upon switching on, current flows through the control wire and a series-connected current-limiting resistance to earth through the coil and indicator lamp filaments, the current value being below that required for illumination. The control wire expands, allowing spring tension to close the main armature, so short-circuiting the control wire and connecting the indicator lamps directly to the battery supply through the coil on the core of the flasher unit. The electromagnetic effect thus produced holds the main

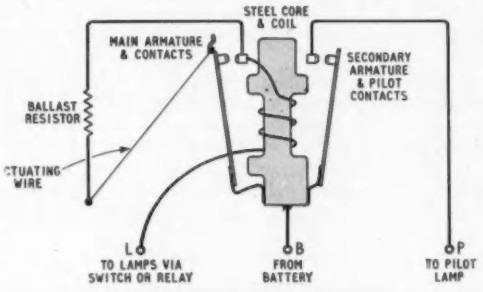


Fig. 14.—Diagram of flasher unit

armature closed against the effects of vibration and, provided the rated current flows, attracts the secondary armature to light a tell-tale light on the dash. Non-illumination of the tell-tale light warns the driver that one of the indicator bulb filaments has failed.

Meanwhile the control wire has been cooling and contracting and eventually it overcomes the combined electromagnetic and spring tension and pulls open the main armature contacts. Indicator and tell-tale lamps are extinguished, current flows again in the control wire, and the sequence is repeated.

Wiring

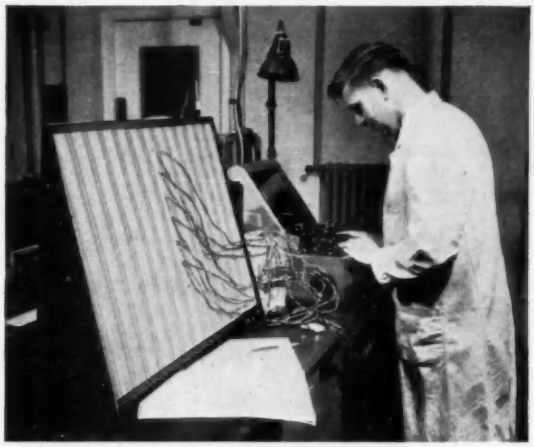
There are, of course, many other applications of electricity to the modern vehicle, among them being fuel gauges and other indicating instruments, overdrive and transmission control circuits, electrical actuation of blinds, windows, aerials, etc., automatic jacking systems and so on, but space forbids more than a mention of these devices.

Finally, therefore, a few words about wiring. The general practice is to use an earth return system in which one terminal of the battery is connected to the chassis or body, which then forms the return path for the current. In British cars, the positive terminal is earthed; this has been shown to have advantages in reducing battery terminal corrosion, spreading burning at plug points and high-tension distributor, and reducing ignition sparking voltage. Cables, of adequate size to minimise the effects on the equipment of voltage drop, are rubber or p.v.c. covered and, to assist in identification, either a cotton braiding carrying a woven-in colour identification is used, or a second-colour tracer is extruded in the p.v.c. covering. The cables are made up for protection into harness form, those running in the same direction being bound together in an enclosing sheath from which short lengths of the individual cables emerge at appropriate points for connection to components.

TEAMWORK IN APPLIANCE DESIGN

THE successful application of industrial design, as was emphasised in a recent article in the *Electrical Review*,* is not achieved by merely improving the external appearance of a product, but depends on the proper integration of other factors such as cost and ease of production and facility of operation and maintenance. A realisation of this fact and the belief that appearance designers should be part of a technical team working in close association, has led the General Electric Co., Ltd., to set up an Appliance Design Centre which can undertake the whole of the work involved in the creation of new designs.

The Centre is divided into five departments. The Cost and Information Department collects information from within the G.E.C. organisation on the market possibilities of a proposed product and advises other members of the Design Centre on the probable manufacturing costs of the different alternatives being considered. The Technical Design Department consists of engineers and physicists, each specialising in a group of related products, and has its own laboratory and workshop space. Drawings for prototypes to be built in the Centre's workshop, and sometimes finished manufacturing drawings, are made in the Mechanical Design Department, which is also responsible for keeping the Centre up to date on new materials and finishes. The Appearance Design Department, which is concerned with such factors as form, colour, fashion, style, packaging and display, is the principal bridge between technical development and the customer. Liaison between the Design Centre and the different factories is the concern of the Planning Engineer's Department, and this also provides advice on tooling and the best utilisation of existing machines and prepares plans for new factory layouts.



Determination of temperature distribution on a "Cosyvec" heater

When it has been decided to proceed with a suggestion for a new appliance, a meeting is held of all those in the Design Centre likely to be concerned, the sales department and the works which will make the appliance. At this meeting a brief, as complete and comprehensive as possible, is prepared to which the Centre may work.

The first stage is for the engineers and physicists to work on the technical aspects of the design and if models are required they are made up in any suitable way and bear no resemblance to the finished product. The working prototypes which are constructed next are technically and functionally as complete as possible. At the same time the appearance designers produce appearance prototypes, largely of wood, which contain no working parts, but simulate exactly both the finish and the form of the final product. When the design has been approved by the works and sales department, the job is handed over to the works so that it can be tooled up. Liaison between the works and the Design Centre means that the works can quote a price very soon after approval has been obtained, thus allowing a production order to be placed.

The Design Centre is the servant of the various factories, not their master, and it undertakes design work on a sub-contract basis. The managements of the factories are therefore encouraged to visit the Centre to follow the work being done, and for its part the Centre acts as a clearing house to ensure that maximum use is made of production facilities by factories helping each other out.

* 19th December, 1958.

Assembling a working model of a prototype toaster

INDUSTRIAL NEWS

New English Electric Subsidiary

The English Electric Co., Ltd., has formed a new subsidiary company with the title of English Electric Aviation, Ltd., to take over all the group's existing activities in research, design, development and production of manned aircraft and guided weapons. The new company will comprise the aircraft division of the English Electric Co., currently centred at Warton Aerodrome, near Preston, and the guided weapons division, based at Stevenage and Luton. The authorised capital of the new company will be £6 million. D. Napier & Son, the aero engine and rocket motor subsidiary, is not involved in the creation of the new organisation, and remains unchanged. The board of the new subsidiary is as follows:—Mr. H. G. Nelson (chairman and managing director), Lord Caldecote (deputy managing director), Sir George Nelson, Bt., Sir John Woods, Sir Conrad Collier and Mr. F. W. Page, who also becomes chief executive of the aircraft division of the new company.

L.E.B. Training Facilities

The London Electricity Board has issued a booklet outlining the training opportunities available for young men and women who enter its service, in which it gives details of schemes of further education, vocational and professional training. There are sections on the training of new entrants, training of existing staff, and spare time activities in which the facilities for recreation provided by the London Electricity Sports and Social Association (Lessa) are briefly mentioned.

Voltage Regulators for Belgium

A number of voltage regulating equipments with their associated boost and stepdown transformers have recently been dispatched from the Crawley, Sussex, works of Brentford Transformers, Ltd., for installation in the port of Antwerp, Belgium. One 3 MVA regulator, to be installed in a substation, is required to give a stable voltage within ±1 per cent against incoming supply variations up to +5 per cent and −10 per cent, on a 6·5 kV, 3-phase, 50 c/s system. Provision has been made on the regulator to increase the output voltage with load to a maximum of 5 per cent on any load power factor between unity and 0·5. A second 5 MVA regulator, which is required for outdoor service, will maintain a constant voltage on a 15 kV, 3-phase, 50 c/s system against incoming supply variations of ±5 per cent, and provision for over-compounding up to a maximum of 5 per cent is included.

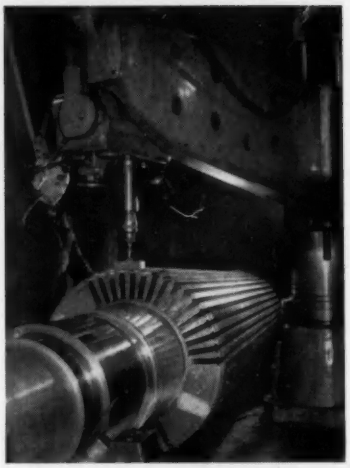
Brentford voltage regulators for Belgium

New Plastics Factory

A new plastics factory to make equipment for the radio industry is to come into operation on 1st February next at Reading. It is to be operated by Resinoid & Mica Products, Ltd., formerly a subsidiary of the Southern Areas Electricity Corporation, Ltd. Resinoid & Mica Products, Ltd., has recently been acquired by Mr. J. R. Severn, who becomes managing director. He has taken over key personnel from the Birmingham plant which will be gradually closed down as the new plant comes into full operation. Both thermoplastic and thermosetting intermediate products will be made. Existing injection presses have been taken over but new compression presses have been installed.

Wire Reference Book

"Lindsay's International Register of Wire, Rod and Strip, 1957-58" has just been published. In a foreword it is explained that the delay in its publication is due to the change in the title of the Register, which was formerly known as "The Wire Reference Year Book." This has led to a flood of data from all over the world and the delay has been occasioned by the introduction of these numerous entries. The alphabetical list of suppliers of wire, rod and strip includes the names of companies in various parts of the world. There are also a classified buyers' guide, a list of metal information bureaux, a brand names section and a series of wire tables. Information is given on the finding of the capacity of drums and reels and how to order wire rope. The Register is published by Lindsay's Wire Publications, 28, Chapel Ash, Wolverhampton, price 25s.



Machining the rotor for the second of five 200 MW steam turbo-alternators being manufactured by the English Electric Co., Ltd., at Rugby for the High Marnham power station

Furnaces for the United States

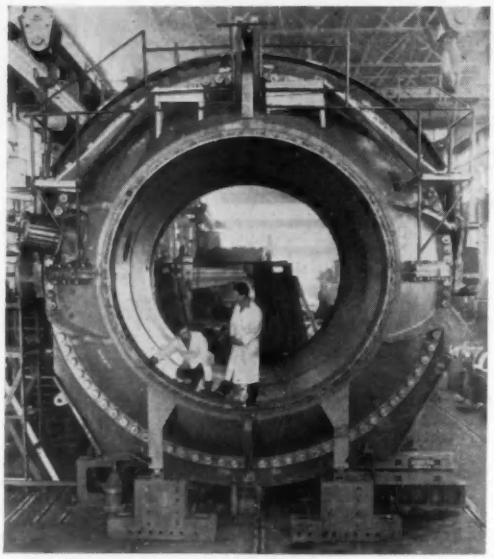
In our issue of 4th July last year we reported that Wild-Barfield Electric Furnaces, Ltd., had received an order for mains frequency induction heated aluminium holding furnaces valued at approximately $300,000 from a large organisation in the United States. The company now informs us that a further order for similar 750 lb capacity equipments has been placed by the same concern.

Midland Management Conference

The 1959 Midland Management Conference of the British Institute of Management will be held at the Town Hall, Royal Leamington Spa, on 26th and 27th February. The subject will be "Management in a Competitive World."

Straight Flow Valves

Five large smooth bore valves designed by the English Electric Co., Ltd., at Rugby are being manufactured



Straight flow water valve for the Bersimis II power station in Canada

by an associated company in Canada, the John Inglis Co., Ltd. These valves, which have a 12ft bore and a diameter of 22ft 6in, will control the water flowing from the 180,000 h.p. turbines now being installed at the Quebec Hydro-Electric Commission's Bersimis II power station, which forms part of the north shore development on the St. Lawrence river.

"Quick Freeze" Exhibition

The Merseyside and North Wales Electricity Board, in conjunction with Bird's Eye Foods, Ltd., Beattie Edwards & Co. and L. Sterne & Co., Ltd., is co-operating in an exhibition to illustrate the growing importance of electrical refrigeration and its application to the quick freezing of foodstuffs and packaged food products. The exhibition will be staged at the Board's Industrial Development Centre, 83, Paradise Street, Liverpool, 1, from 3rd to 13th February. It will cover the marketing of frozen food from field through factory and distributor to consumer. Invitations are being sent out to grocers, greengrocers, fish retailers, wholesale food merchants, butchers, dairymen and ice cream retailers, catering superintendents, shipping suppliers and representatives of the hotel, restaurant and catering trades.

Training for Selling

During the first six months of the year the Incorporated Sales Managers' Association is holding a series of week-end and five-day courses in sales planning and sales promotion techniques. There will also be a single five-day course for those engaged in training salesmen. The first course began on 9th January at St. Peter's Hall, Oxford, and subsequent courses will be held at Ascot, Ashridge College and Glasgow.

The arrangements are under the supervision of a distinguished committee of sales directors and sales managers, several from electrical firms. The week-end courses will be for those at the beginning of their careers and the longer courses for those in senior positions. In each case the emphasis will be on practical work and for the most part students will study in groups to solve problems by discussion and individual thought. New sales training techniques will also be demonstrated.

The Association has also instituted the George Drexier Ofrex Travelling Award, which will be competed for by finalists in the Association's examinations in 1960 or 1961 and annually from 1965. The holder of the award will normally go to North America but if he is multi-lingual he may choose Europe.

Large Thermo-Siphon Cooled Diesel

Mirrlees, Bickerton & Day have recently produced what they believe to be the largest diesel engine with total thermo-siphon cooling yet built. It is a 2,724 h.p. 450 r.p.m. engine which will drive a 60 c/s Brush alternator and is one of two sets being supplied to the United States Information Agency.

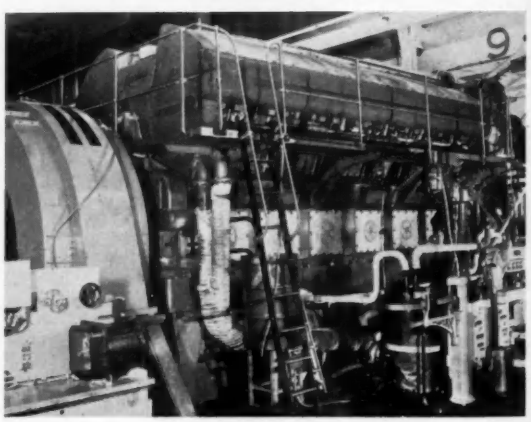
Briefly, the benefits obtained from the application of high temperature cooling on an evaporative cycle are as follows:—

(1) The engine, regardless of load, maintains a constant circulating water temperature; (2) when operating at high temperature there is no possibility of the exhaust gases falling to below their dewpoint, and this has the effect of decreasing the cylinder liner wear; and (3) when using heavy fuels greater thermal advantage is obtained and steam produced by the steam separator can be utilised for heating fuel to its correct viscosity. The engine is required to operate at a maximum water outlet temperature of 250 deg F and to work on a thermo-siphon jacket cooling water circuit. The normal accepted practice for diesel engine cooling is a closed circuit with a maximum temperature at the water outlet of 180 deg F.

Cooling is effected by removing the latent heat from the engine jacket circulating water in the form of steam and the heat circuit operates as follows:—Heat is given up to the engine circulating water until it reaches a predetermined temperature governed by the steam pressure. The engine jacket water circulates in a closed system to a steam separator where, due to a drop in pressure, it flashes off in the form of steam, thus removing the excess B.Th.U.s in the form of latent heat. The "discharge" steam at 15 p.s.i. will be utilised for sea water distillation. There is a steam separator for each bank of six cylinders and two opposite banks work independently of one another. The water level is automatically controlled by Mowbray electric water level units operating their own ram type make-up feed pumps. The engine has twelve cylinders with a 15in bore and an 18in stroke. It is totally enclosed with a four-stroke cycle and has solid injection. It is fitted with a Westinghouse combined electrical and mechanical governor.

In addition to standard protection gear there are alarms designed to operate in the event of the lubricating oil temperature rising to 180 deg F and of pressure falling to 12 p.s.i.

Mirrlees, Bickerton & Day 2,724 h.p. diesel engine with high temperature cooling

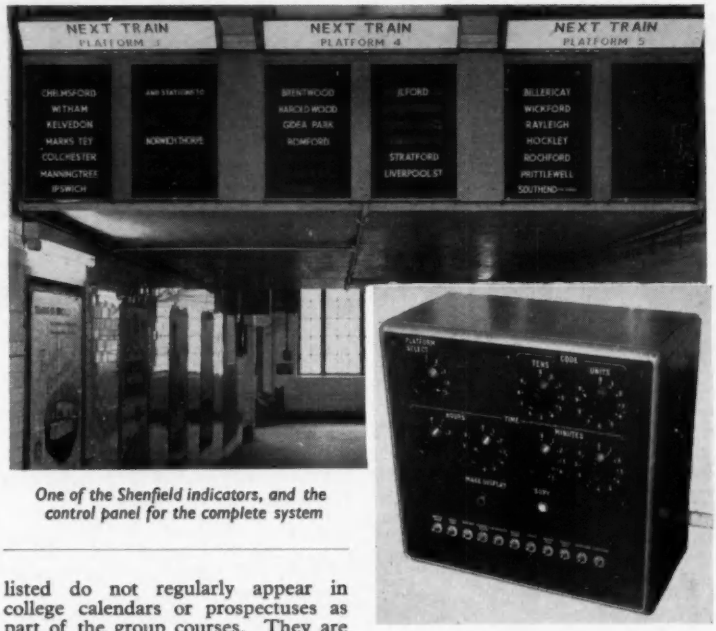


Shenfield Train Indicators

A system of electrically operated train departure indicators has recently been installed at Shenfield on the Eastern Region of British Railways. The station has a variety of train services with a considerable amount of interchange traffic, since it is a junction for two routes of electric suburban trains and a terminating point for some services, in addition to being a stopping place for main line trains. An inter-related system of

indicators enabling the displayed information to be quickly and easily altered by the minimum of staff, particularly at peak periods, was therefore necessary, and this has been attained by using nine Siemens Edison Swan high-speed indicators throughout the station, all controlled from one central position. A main indicator showing the destination and time of the next departures from each platform is located in the ticket hall, with two repeaters situated in the platform interconnecting subway, whilst separate indicators are used on each platform.

Each indicator consists of a series of vertically banked hexagonal rotating drums, bearing the appropriate station names displayed through a masked panel so that only the name required is visible. These drums are rotated by small built-in motors, controlled by relays and operated by means of a simple code system. Each combination of stopping places for trains leaving the station is given a two figure number which, when set up on the control panel's rotary switches, is held unshown until a "Make Display" button is depressed. This enables the next departure to be set up and held in readiness until required, whilst a display is being shown. At Shenfield the control panel is operated by the train announcer, ensuring that visual and oral information to passengers is related.



One of the Shenfield indicators, and the control panel for the complete system

Domestic Equipment Fair

B. & C. D. Trade Exhibitions, Ltd., announces that the second Domestic Equipment Fair will be held at Earls Court from 17th to 26th September next. The first two days are to be set aside for the trade. The organisers are Domestic Equipment Fair, 194-200, Bishopsgate, London, E.C.2.

Courses in Higher Technology

A bulletin listing special advanced courses held in London and the Home Counties region has been issued by the Regional Advisory Council for Technological Education. The courses listed do not regularly appear in college calendars or prospectuses as part of the group courses. They are usually part-time or evening courses but full-time courses which are specially arranged over periods of not more than three months are also included. A copy of the bulletin (price 3s 6d) may be obtained from the Secretary, Regional Advisory Council, Tavistock House South, Tavistock Square, London, W.C.1.

Falks Johannesburg Showroom

Falks Electrical (S.A.) (Pty.), Ltd., the South African subsidiary of Falk, Stadelmann & Co., Ltd., London, opened a new showroom in Johannesburg on 26th November last. The premises are in Commissioner Street, which is a main thoroughfare of Johannesburg. The showroom is stocked with a wide variety of fittings originating primarily from the factory in England and also from the factory outside Johannesburg. Fittings from other European countries are also on display to meet the varied tastes of the South African market. The opening ceremony was performed in the presence of the British Trade Commissioner for the Union of South Africa and a large gathering of the leading personalities in the architectural and engineering fields. The new showroom was designed by Mr. M. Kramer, director in charge of the South African organisation of the company.

Interior view of the new Johannesburg showroom of Falks Electrical (S.A.) (Pty.)

New Trading Terms

Crompton Parkinson, Ltd., announces a new home trading code, as from 1st January, for users, contractors and resellers of Crompton lighting fittings and control gear.

Atlas Lighting, Ltd., and Ekco Ensign Electric, Ltd., also announce adjustments to the quantity discount and rebate scale for contractors and re-sellers of Atlas and Ekco lighting fittings. The new quantity discount terms are effective from 7th January and revised rebate scales from 1st July.

Valve Exhibition

An exhibition will be held by the English Electric Valve Co., Ltd., of Chelmsford, at the Kensington Palace Hotel from 17th to 21st March inclusive. Modern valve design techniques for radar, communication, transmitting, sound and vision broadcasting and instrumentation will be displayed and the latest types of storage tubes will be exhibited.

Training Radio Officers

R.M.S. *Wray Castle*, Ambleside, Westmorland, is the latest radio college in the United Kingdom to be granted a G.P.O. licence. Marine radio equipment has been supplied by Siemens Edison Swan, Ltd., and is of the standard type as fitted in ships.

Public Transport Association

The annual conference of the Public Transport Association will be held at Folkestone from 12th to 14th May. The programme will include an official

welcome to delegates by the Mayor of Folkestone, papers to be presented by Mr. A. J. White (general manager, Maidstone & District Motor Services, Ltd.) and Mr. F. H. Clayton (deputy general manager, Liverpool Corporation Transport), and the annual general meeting of the Association. A number of social functions have also been arranged.

Electronic Digital Computers

The third conference in the series on electronic digital computers and their industrial applications at the College of Technology, Gosta Green, Birmingham, will be held on 25th February, when members of the English Electric Co., Ltd., will deliver talks. Applications for the course should be made to the Registrar of the College.

New Showcards

Brook Motors, Ltd., is offering a new showcard, for window and counter display, showing its new "C" type motor. It measures 15in by 12in and is of the photographic type. The showcard is attractively designed, with the motor in black and white, and the background brightly coloured. Copies of the showcard are available free of charge from the Publicity Department, Brook Motors, Ltd., Huddersfield.

Metway Electrical Industries, Ltd., has issued a new counter display for its "Coolerway" extractor fan.

"Transport Age"

The January issue of *Transport Age* (published by the British Transport Commission) includes an article on the recently electrified Manchester-Sheffield-Wath lines on which freight traffic predominates. Many of the illustrations are in colour. The issue also contains an interesting article on industrial Yorkshire.

Trade Announcements

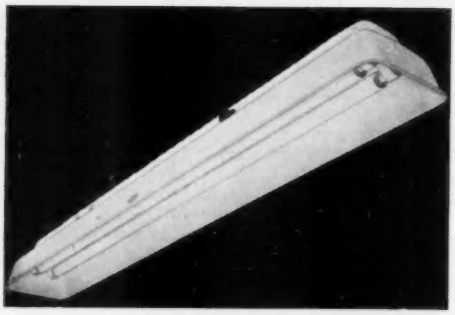
Davis & Timmins, Ltd., has been appointed a main distributor of Holo-Krome socket head screws. The Holo-Krome Co. has been established in the United States for more than thirty years. In order to facilitate the sale of its products in the United Kingdom and on the Continent, a factory and plant has been established in Dundee and is now producing a full range of socket screws.

Mr. L. Broadbent, representative for **Oldham & Son, Ltd.,** working from the company's Birmingham depot, has moved to 8, Cobham Road, Pedmore, Stourbridge, Worcestershire (telephone: Stourbridge 3391).

Mr. A. M. Seggar has been appointed lighting engineer for the Bristol Area of the south-west region of **Philips Electrical, Ltd.**

The address of the Preston area office of the **A.E.I. Lamp & Lighting Co., Ltd.,** is now Strand Road, Preston (telephone: Preston 86701).

FLUORESCENT FITTINGS



A typical example of a Benjamin "Taskmaster" closed end reflector and channel for fluorescent lighting

A WIDE variety of reflector shapes and finishes for 4, 5 and 8ft fluorescent lamps is to be found in the "Taskmaster" range of "Flurolier" fittings just announced by the Benjamin Electric, Ltd., Tottenham, London, N.17. The new range is designed to meet a high proportion of industrial and commercial fluorescent lighting requirements and is obtainable in a number of reflector finishes ranging from "Crysteel" vitreous enamel to acrylic plastic.

The reflectors are, in fact, a major development in fluorescent reflector design and manufacture. They are pressed in one piece, with curved ends, and are in two sizes, 5ft 80 W and 4ft 40 W. Open-ended reflectors are also available in these variants and there is an angle reflector for 5ft 80 W lamps. Each will take one or two lamps and is available with upward light slots or closed top, except the angle reflector which has closed top only.

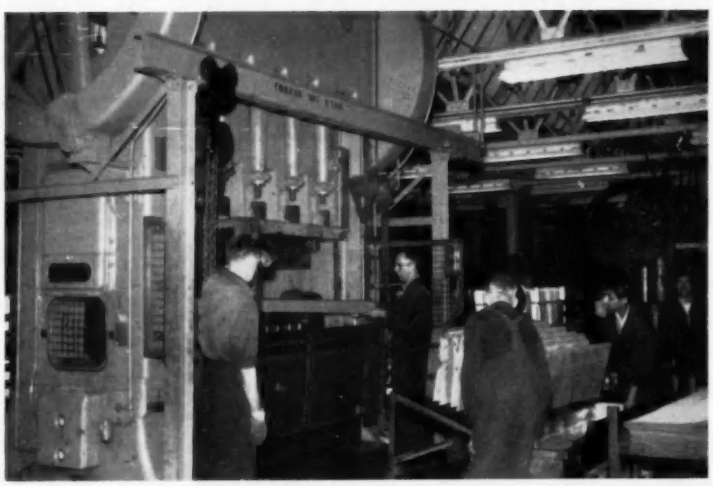
The channels are also one-piece pressings styled to flow with the curves of the reflectors. Gear slide rails have been incorporated as before. The wing headed reflector fasteners have an improved shape, making location easier, and the method of preventing them from turning has been simplified by using friction washers instead of springs. Miniature glow-type starter switches, with minimum projection, are used on switch start circuits to improve the appearance. For the same reason, where plugs and sockets are used, they are moulded in white material.

The lampholders for 4ft and 5ft lamps are of the bi-pin type in white plastic. Translucent opal plastic egg-crate louvres are available if required.

The reflectors of the 8ft lamp fittings are in two nominal 4ft lengths, each length with two slots for wing nut fasteners. They are all open-ended reflectors with upward light slots or closed top in "Crysteel" vitreous enamel or "Peropal" finish. The channels are in one length, with a similar cross-section to the existing single lamp channels, and are equipped with single or twin r.d.c. (recessed double contact) lampholders. The standard control gear is quick start.

The fact that the "Taskmaster" reflectors and channels are each pressed in one piece, with other features, has resulted in price reductions in a number of cases.

One of the latest 300 ton presses, with air cushions, in the press shop at the Benjamin works used in the manufacture of "Taskmaster" fluorescent fittings



SILICONE INSULATION

By J. H. DAVIS, A.M.I.E.E.*

Author's summary of paper entitled "Silicone Electrical Insulation," which was read before a joint meeting of the Measurement and Utilisation Sections of the Institution of Electrical Engineers

SILICONES are chemical compounds based on a structure of silicon and oxygen atoms, with organic groups also attached to the silicon atoms. They are available as fluids, greases, rubbers and resins, having good dielectric properties and water repellency combined with outstanding heat endurance. Little variation occurs in electrical and physical characteristics over a wide temperature and frequency range.

Silicone fluids have been used in special types of capacitor and high-temperature aircraft transformers, but their most common application in electrical equipment is in switchgear delay mechanisms as dashpot fluids, because of their stable viscosity-temperature characteristics. Silicone greases show little change in consistency from below 50 deg C to above 200 deg C, and are used as water repellent anti-tracking treatments for insulators, cable junctions and similar applications.

Silicone rubbers are made from high-viscosity silicone fluids, or gums, which are compounded with inorganic fillers and curing agents. Curing is usually effected by heating, often while applying moderate pressure, but some types can be cured at room temperature by adding a suitable catalyst. Silicone rubbers are used to make heat-resistant cables and sleeving, tapes and other insulation components. A recently developed tape will bond without requiring heat or pressure, and should prove attractive for many applications.

Silicone resins of various types are used for coating glasscloth, tapes and sleeving, bonding glasscloth laminates, treating glass-covered conductors, mica bonding and impregnating electrical equipment.

Impregnating Varnishes

The most commonly used silicone impregnating varnish shows little tendency to bubble when cured directly at 200 deg C for most applications. Alkyd modified silicone varnishes have proved valuable as wire enamels, for coating glass-covered conductors and for impregnating electrical equipment where good resistance to oils and other solvents is required.

The full utilisation of silicones and other new insulating materials depends largely on the development and international acceptance of accelerated tests which will enable the performance of complete equipment, over about twenty years, to be predicted from tests lasting, say, two or three years. One of the earliest silicone insulated motors to be put on test has not yet failed after more than thirteen years' operation at 240 deg C. Silicone insulation is suitable for use at 180 deg C, as in Class H insulation (B.S. 2757), while many silicone resins in conjunction with mica, glasscloth and asbestos are suitable for use at higher temperatures as Class C materials. International standards are generally similar.

Silicone varnished, glass-covered conductors are used not only in Class H equipment, but also in much Class B (130 deg C) and Class F (155 deg C) equipment, in which case suitable organic impregnating varnishes are often used. The superior heat endurance of the silicone treated conductor insulation gives higher reliability at little increase in cost, though full silicone insulation with impregnation in silicone varnish is necessary to utilise this property fully. Silicone rubber insulated cables are used widely for wiring aircraft, warships and, recently, some merchant ships, and in high-temperature industrial applications. High current densities can be used, with a corresponding reduction in copper weight. After prolonged exposure to flame a silica residue still remains to insulate and support the conductor so that the cable continues to function.

Electric motors with silicone insulation are particularly valuable where a high ratio of power to weight is required, as in aircraft equipment; where high overload capacity is required, as in traction and mill motors; and for operation at high ambient temperatures.

Dry-type distribution transformers insulated with silicones and inorganic materials may be installed at load centres where fire risk exists, and are also much lighter than oil-filled units. Smaller silicone insulated transformers are used in aircraft, for welding and illumination supplies, and in other applications. Silicone insulation is also used in a wide variety of industrial and domestic heating appliances, and in electronic equipment where stability in dielectric characteristics with varying frequency and temperature is required. An important example is a recently designed television tuner unit, which includes printed coils and capacitors on a silicone resin/glasscloth laminate base.

Relatively high costs limit the use of silicone insulation in many applications, so that the general replacement of Class A (105 deg C) and Class E (120 deg C) materials is unlikely. However, the trend towards the use of silicones in much Class B equipment is expected to continue. In particular, the silicone rubbers are versatile in application and, in the form of tapes, are used in appropriate applications as a substitute for organic resin bonded mica/glass. Continuous research is directed towards the development of new silicone products with improved properties.

DISCUSSION

Mr. S. W. Messent said that a material was now available in this country consisting of a mica paper which could be impregnated with silicone resins and converted into slot insulation with a backing of glass fibre or mica. On future development, he remarked that one of the weaknesses at present was adhesives. These materials were available, but in his experience the methods of building up assemblies with silicone-type adhesives were

* Midland Silicones, Ltd.

not very good. This also applied to the glass-cloth laminates.

Mr. W. J. Renwick (G.E.C.) thought that silicone materials would undoubtedly be used more and more as occasions arose which justified the cost, with the need for greater reliability under extreme conditions of temperature and mechanical loading. In his view, more information was required on excessive brush wear, a problem that had recently arisen in steelworks.

Mr. D. B. McKenzie said he believed, though he was open to correction, that the Royal Air Force Establishment at Farnborough was the first user department to solve the use of silicones, and he described some of the stages in development. He then asked whether there was any possibility of fluorinated silicones being developed which could be extruded so that a fluorinated silicone cable could be obtained for aircraft use which would resist all the fluids that might be encountered and yet have sufficient mechanical rigidity to stand up to normal installation problems in an aircraft factory.

Dr. J. H. Mason (E.R.A.) would have liked more information about the electrical properties of silicone insulation. Although he realised that viscosity and thermal stability were its chief attributes he thought that the effect of electrical discharges on functional tests might be considered, and he described tests carried out by the Electrical Research Association in this connection.

Mr. E. Jones (E. E. Co.) thought the use of silicone resins for the bonding of micanite needed further study. The resins appeared to be unusually solvent-retentive, and curing was inhibited, the electric strength being comparatively low. Solvents other than the usual toluene and xylene might be more readily removed, and it would be interesting to know whether they could be used successfully.

Mr. R. Snadow (B.T.H.) suggested that although there was little demand for the operation of large rotating machines at Class H temperature, it was interesting to speculate on the use of a silicone rubber to insulate high-voltage stator coils by extrusion or moulding techniques. It might be possible to apply the major insulation in one operation, and thus supersede the costly wrapping and taping processes now in use. In the end, the covering might be no more expensive or even cheaper, although more expensive materials were used.

Optimum Thermal Endurance

Mr. M. Parkman (E.R.A.) said it would appear to be axiomatic that to obtain the optimum thermal endurance it was necessary to increase the phenyl/methyl ratio. If so, this seemed a pity because, apart from the additional polarity, it would give rise to depressed mechanical properties, and there was also the question of carbon track formation.

Mr. S. G. Foord thought that when the Grignard reaction, an essentially expensive chemical process, was replaced by the direct process the price would have dropped substantially, but he did not remember this taking place.

Mr. E. T. Norris said that a great deal had been heard about temperature properties. If transformers could be designed to take advantage of a higher temperature rise, their size could be reduced and the extra cost of insulating materials offset. But not much attention had been paid to the temperature reached on short circuit to which all transformers were liable.

Mr. A. H. Lince (Bell Telephone Laboratories, New Jersey) asked for information about silicone oils since they did not promote stress cracking in polythene. This subject was of interest to engineers concerned with the moulding of polythene in long-life products, such as submarine cables, where small levels of stress-cracking activity were very dangerous.

Mr. J. K. Clark asked whether the remarkable increase from 450 to 1,500 p.s.i. in tensile strength was achieved by altering the molecular structure or by adding materials, as in the case of the increased tensile strength of steels. He asked also about the effect of nuclear radiation upon the silicone insulating materials and their behaviour in cooling media such as hydrogen and nitrogen. Hydrogen in particular, he said, was becoming an important cooling medium for large alternators.

The author replied at some length.

NEWS FROM INDIA

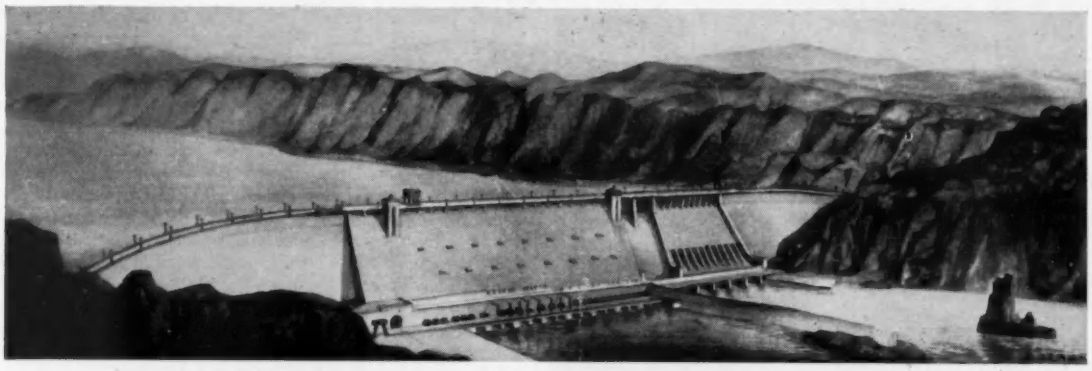
From Our New Delhi Correspondent

COMMERCIALLY exploitable oil has been struck at Cambay, in Saurashtra, about 400 miles north of Bombay, according to an announcement by Mr. Malaviya, Minister of Oil. The oilfield is described as "unusually" rich. This is the second recent strike, the first having been at Jwalamukhi, Punjab. Cambay is within a hundred miles of Ahmedabad, the textile centre of Western India which relies a great deal on coal from Bihar-Bengal coalfields (over seven hundred miles away) for fuelling its power stations. It is in this area that the Atomic Energy Commission proposes to build a 250 MW nuclear power station, but should the newly discovered oilfield prove to be fairly substantial the Commission's plans may be affected.

The use of bullocks to generate electricity was demonstrated recently at Khanpur, 18 miles from New Delhi. The experiment is being conducted by Mr. Leigh Stevens, an American management consultant, with the assistance of U.S. industrial firms including General Electric, and with the co-operation of the Government of India and the Ford Foundation. Besides the generation of electricity, the Khanpur project includes a bullock-driven pump, power-equipped carpentry equipment and an improved brick-making process. The bullock-powered generator is capable of delivering 4½ kW at 125 V d.c., and the cost of the combined pump and generator unit is estimated at about Rs.20,000 (£1,500).

The pump unit as established at Khanpur consists essentially of three parts: the positive displacement rotary pump; a vertical drive shaft; and the driving mechanism. The driving mechanism consists of two drawbars turned by bullocks walking in a circle, and thereby revolving a series of chains. In the pump-driving mechanism, two stages of sprockets are used, the first set converting the 2 r.p.m. bullock speed to 20 r.p.m., and the second to 150 r.p.m. For running the electric generator, a third increase in speed is achieved by belts in the same driving mechanism, raising the 150 r.p.m. to 1,220 r.p.m. The pump, as installed, has a lift capacity of 300 gal/min compared with the 40-50 gal/min of the traditional Persian wheel used in India. The generator is turned by bullocks pulling the same drawbars as for the pump; the pump is simply switched off and the generator switched on.

The cost of bringing electricity to Indian villages by conventional transmission systems is now estimated at Rs.60,000 (£4,500) per village. There are about 550,000 villages in India of which only about 20,000 have been electrified so far. The cost of electrifying the rest would work out at Rs.3,200 crores or £2,400 million. This is the cost of transmission only.



Chinese artist's impression of the completed Sanmen Gorge dam. It was designed in Leningrad

Chinese Hydro-Electric Project

DEVELOPMENT OF THE YELLOW RIVER

By ROBERT WESTGATE

Salient features of an 1,100 MW development on the Yellow River are given and the author proceeds to deal with the long-term programme of hydro-electric production drawn up by the Chinese Government. Electrical manufacturing in China is also briefly touched upon.

WHAT is to be China's biggest hydro scheme is now under construction at Sanmen Gorge, Shanhsien, Honan Province. Work on the project began in April last year and the station is due to generate its first electric power on 1st April, 1961. Sanmen Gorge is an extremely narrow bottleneck in the middle reaches of the Yellow River ("China's Sorrow"). It is the last of the gorges through which the river—the second longest in China after the Yangtse—passes, the sides rising sheer. The gorge is fairly narrow and the river bed, diorite porphyry rock, provides a perfect foundation for a dam.

The power station is to house eight 137·5 MW units, a total capacity of 1,100 MW—greater, the Chinese point out with pride, than the Beauharnois station in Canada, the Bhakra in India and the Dnieper in the Soviet Union. The annual output of the station will be 6,000 million kWh, an amount greater than the power generated in the whole of China in the peak year during the Second World War. It will be highly automatised and in normal conditions there will be nobody in attendance in the machine room. The plans for Sanmen Gorge were drawn up for the Chinese by the Leningrad branch of the Soviet State Institute for the Planning of Hydro-Electric Power Stations.

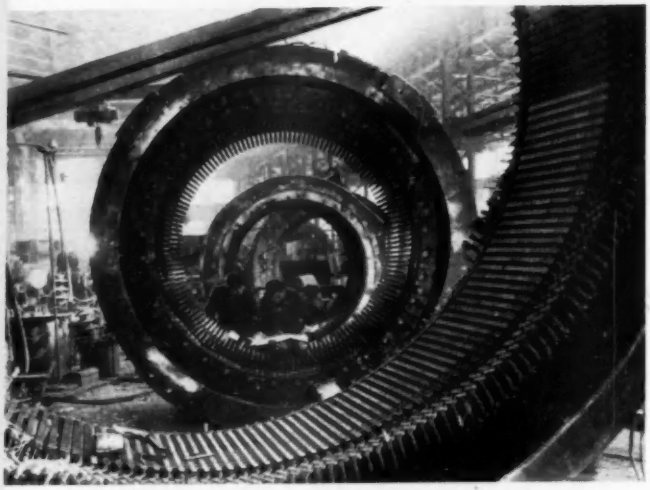
The dam will be 361ft high, the same as the planned Aswan Dam in Egypt, and 2,753ft long. It will retain a head of water over 1,000ft above sea level and create an artificial lake with an area of 1,400 sq miles and a capacity of 84,757 million cu yd, greater than the Kuibyshev Reservoir in the Soviet Union.

The Sanmen Gorge project is part of a multiple-purpose plan to control the Yellow River and exploit its resources for industrial and agricultural purposes. Forty per cent of all China's farmland lies in the Yellow River valley and full exploitation of the river will greatly increase the area of irrigated land, make several hundred more miles of waterways navigable by steamships, and increase the country's supply of power. The Sanmen Gorge dam will be the first and biggest of some 40 dams and reservoirs to be built along the whole river.

History records more than 1,500 floods of the Yellow River and breachings of its dykes. For many years the average flow at Sanmen Gorge has been only 45,890 cu ft/sec, but at the flood season it sometimes reaches 1,270,800 cu ft/sec. Also at the gorge every 10 cu ft of water contains over 21 lb of solid matter in suspension, more than in any other river in the world.

Sanmen Gorge power station will be only about 300 miles from the important and rapidly growing industrial cities of Loyang, Chengchow, Taiyuan and Sian and will supply them with power. Industries scheduled for major development in this region include aluminium, magnesium, titanium, copper and coal, and heavy engineering, for all of which cheap power will be of extreme importance. Power for the building site is being delivered over transmission lines from two new thermo-electric power plants at Chengchow, now an important textile centre, and Loyang, where China's first tractor works is being built.

Last year China produced about 22,450 million kWh of electric power, or 18 per cent more than in 1957, and construction began on 100 power stations—76 thermal and 24 hydro-electric. The power target set for the last year of the country's second five-year plan, 1962, is 40-43,000 million kWh. The long-term policy recently laid down for the electric power industry in China puts main emphasis on the building of hydro-electric stations.



Work proceeds on an 8,750 kW generator for Yili (Yunnan) power station at the Harbin machine-building works

In 1958 almost twice as much was invested in hydro-electric power projects as in 1957. The stations on which construction was due to begin included the following:— One on the Tzushui River, a tributary of the Yangtse River in Hunan Province (396 MW); a 580 MW station on the Hsinan River in Chekiang Province; a 360 MW station on the Yili River in Yunnan Province; a 300 MW station on the Min River in Szechuan Province; and a 290 MW station on the Hun River in Liaoning Province.

Also in 1958 preparatory work was started on the prospecting, surveying and planning for the Yangtse River Gorge water conservancy and power generation project, the country's most ambitious power production scheme, which represents about two-fifths of China's potential hydro-electric power. When the water resources of the Yangtse are fully exploited, a nationwide transmission grid may become possible. Meanwhile more immediate plans provide for the Shensi-Shansi-Honan grid with the Sanmen Gorge station as its centre, the Kansu-Chinghai grid centring on the Liuchia Gorge station, the Kiangsu-Chekiang grid with the Hsinan River station as its centre, the Yunnan grid based on the Yili River station, the Kiangsi-Kwangtung grid based on the Liuchi station at Shangyu, Kiangsi, the Sinkiang power network based on the Urumchi power station, and others in Szechuan and Hunan Provinces.

Given the present steadily increasing tempo of industrialisation and other development in China, it seems likely that the country's power programme will advance more rapidly than was foreseen when the current five-year plan was first drawn up in 1956. In April it was announced from Peking that the date for completion of the Sanmen Gorge project had been brought forward to the end of 1961, a year ahead of the original six-year schedule. Although the labour force engaged on this scheme is vast by most standards (no fewer than 5,000 workers assembled on the job for the start of operations in April, 1957), extensive use is being made of the latest Soviet earth-moving and other equipment.

China's electrical engineering industry has also made important advances in recent years. It is now manufacturing 15 MW hydraulic turbines, 12 MW steam turbines and other major items. Trial production of complete units of 72 MW hydro power and 25 MW thermal power installations was completed in the latter part of 1957. However, a good deal of equipment continues to be imported, much of it from the Soviet Union. One of the most up-to-date electrical manufacturing works is that at Harbin, North-East China, which is being expanded to build steam turbo-generators up to 25 MW and 100 MW hydro-electric sets.

Construction work in progress at Sanmen Gorge

Transistors for Communication Equipment

By H. T. PRIOR, B.Sc., D. J. R. CHAPMAN, B.Sc., and A. A. M. WHITEHEAD, B.Sc.

Authors' summary of a paper entitled "The Application of Transistors to Line Communication Equipment," read before the Radio and Telecommunication Section of the Institution of Electrical Engineers on 5th January

GERMANIUM alloyed-junction transistors have been developed to the point where they are sufficiently reliable for use in communication equipment. Their power economy, long life and compactness give them great advantages over thermionic valves, but their advantages must be assessed on an economic basis. Their longer life will reduce maintenance costs, while the low power consumption reduces operating costs and the cost of power equipment. Where 24 or 50 V batteries are available no other form of power equipment is required. The heating of the equipment itself and of the surrounding air, which is becoming a serious problem with valve equipment, is no longer a difficulty. The small size and reliability of transistors give greater freedom in equipment construction. On the other hand, the initial cost of transistor equipment is no less, since more transistors than valves are required for a given task. At present the frequency range of transistor equipment is limited to about 1 Mc/s by the high frequency restrictions on available transistors. The power dissipation is also limited, and greater expense is incurred if operation at high power or at a high temperature is required.

Valve-Type Circuits

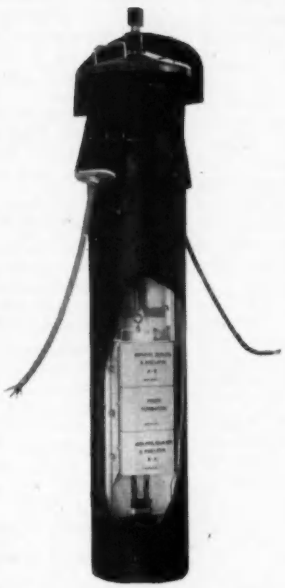
In introducing transistor equipment a natural first step is to make equipment compatible with existing valve equipment. Compatibility may be required to enable a valve equipment at one end of a line to be connected to transistor equipment at the other, so that the same frequency grouping must be employed, or transistor and valve equipments may be connected to different pairs in the same cable or following the same pole-route so that to restrict cross-talk, power levels of transmission must be comparable. The use of transistors enables the power consumption to be reduced by a ratio of 10:1, and the space occupied is reduced by about 2:1.

New Transistor Systems

To obtain the fullest benefits from the use of transistors it is necessary to design new types of system. The special properties of transistors lead to systems which previously were impracticable or uneconomic because of maintenance difficulties, power supply requirements or accommodation. The following equipments will illustrate these points:—

Rural Carrier System.—In areas served by long open-wire lines for subscribers' loops, a rural carrier system can provide up to ten two-way carrier channels on one pair of wires by using frequencies up to 172 kc/s. With transistors the terminal equipment is simple and compact enough to be set up in a subscriber's house and powered where necessary by primary cells.

Small Diameter Coaxial Cable System.—With a coaxial cable of 0·144in diameter in place of the usual 0·375in diameter cable, a transmission system has been developed using transistors to convey 300 telephone channels. The repeaters spaced at 2½ mile intervals can be housed in small underground containers, and power can be fed to the repeaters from points 78 miles apart. Since the cable is less costly than usual and no repeater buildings are needed this system is very economical. The illustration reproduced below shows a typical repeater.



Underground repeater housing for small diameter cable system

Digital Equipment, in which a number of low-power active devices are required, is much more attractive with transistors than with valves. A telegraph "start-stop" regenerative repeater has been developed which regenerates an undistorted signal from a distorted input and provides safeguards against incorrect operation.

Telephony also becomes amenable to digital transmission by using pulse code modulation which provides a signal similar to a very fast teleprinter-type code. Multi-channel transmission is obtained by sequential interleaving based on time, instead of on frequency. Regenerative repeaters can be used, and transmission circuits can be utilised which have noise and cross-talk too great for normal types of transmission.

Future Developments

Continual improvements are being made in transistors. Frequency range, power handling and high-temperature operation are all being extended, and more is being discovered about how to achieve long life. Alloyed junction transistors are likely to give place to diffused layer structures, and germanium may be ousted by silicon or an intermetallic semiconductor. Transistors capable of handling signals of ten or twenty megacycles are now in production in the U.S.A. They will permit the development of systems transmitting 3,000 or more telephone channels on a single pair of wires, with small regularly spaced underground repeaters. It is to be expected that as a result of these developments transistors will entirely displace valves in any new designs of land-line transmission equipment within a few years.

GENERATION and DEVELOPMENT

Lower Coal Consumption

Although about 8½ per cent more electricity was produced in power stations in this country in the 52 weeks ended 26th December, 1958, than in the corresponding period of 1957, less coal was consumed. Figures just published by the Ministry of Power give the aggregate consumption last year as 46·2 million tons against 46·5 million tons in 1957. This was partly due to greater use of oil as fuel and partly to increased thermal efficiency. At 27th December coal stocks at power stations amounted to 7·5 million tons (7·4 winter weeks' supply), compared with 7·8 million tons (7·1 weeks' consumption) at 28th December, 1957.

Rewiring of Council Houses

The surveyor to the Boldon (Co. Durham) Urban District Council reported recently that the electrical wiring of houses built more than 30 years ago had seriously deteriorated, and in certain instances the North Eastern Electricity Board had insisted on houses being completely rewired. Houses in the Marsden area appeared to be most affected. The Council decided that complete rewiring should be carried out where necessary.

Conway Castle Floodlighting

A new Atlas floodlighting installation was recently completed and switched on at Conway Castle and Bridge, Caernarvon. The installation sets out to light effectively the eastern and northern faces of the Castle, presenting a night-time picture of the Castle as it is viewed from across the new Conway Bridge or from the town.

On the eastern face 2,000 W incandescent lamps provide a high level of illumination, emphasising the massive strength of the Castle walls. In contrast, the northern face is lighted by fluorescent tubes to a lower intensity to give a proper sense of perspective. The majority of the tubes are either gold or blue. The incandescent lighting from the south-east corner of the East Barbican is continued across the top of the towers to highlight the battlements. This technique of associating incandescent and fluorescent lighting in one installation is based on experience in recent *Son et Lumière* spectacles and it is of interest that where variation of colour and illumination is required all these light sources can be controlled by Atlas electronic dimming equipment. The installation was planned by Atlas Lighting, Ltd., and installed by the Merseyside and North Wales Electricity Board.

In the floodlighting of Conway Castle fluorescent tubes are used in association with incandescent lighting

Revised North Eastern Tariffs

Following the announcement of the new bulk supply charges for 1959-60 the North Eastern Electricity Board has published details of changes in its tariffs which will take effect from the first normal meter readings following 31st March. Apart from the alterations in the maximum demand tariffs, which will benefit large consumers, the second step of the domestic block rate is being eliminated and new terms offered for off-peak supplies.

Industrial Tariffs "A" and "M".—Fixed service capacity charge 5s/kVA (unchanged). Annual demand charges increased by £1 in each step and monthly rates by 2s.

"Unit" charges. High voltage: First 150 kWh a month per kW, 0·64d; 150-360, 0·59d; 360-550, 0·515d; over 550, 0·48d (at present three steps 0·7d/0·65d/0·575d). Low voltage: 0·67d/0·62d/0·545d/0·51d (at present 0·74d/0·69d/0·615d).

Fuel cost adjustment: 0·00059d (h.v.) and 0·00063d (l.v.) per penny variation in the price of coal from the basic figure of £3/ton (at present 0·00065d and 0·0007d respectively).

Commercial Tariff C.6.—Annual demand charge per kW: First 10 kW at £10; next 190, £8; over 200, £7 15s (at present first 10 at £10; next 90, £7 10s; over 100, £6 10s.

"Unit" charge: First 150 kWh a month per kW, 0·64d (h.v.) and 0·67d (l.v.); next 210, 0·59d and 0·62d; over 360, 0·515d and 0·545d (at present 150 kWh at 0·76d (h.v.) and 0·8d (l.v.), 100 at 0·685d and 0·725d; over 250, 0·61d and 0·65d. Fuel clause as above.

Commercial Tariff C.1.—As at present except that second block at 2½d is reduced from 2,250 to 2,100 kWh.

Commercial Tariff C.3.—First block at 2½d reduced from 2,250 to 2,100 kWh.

Domestic Tariff D.1.—First block of 11 kWh per room each quarter at 6d/kWh; all in excess at 1d (at present 10 kWh at 5d, 10 kWh at 2½d and all in excess at 1d).

Farm Tariff F.1.—Fixed charge on capital expenditure as before (£1 17s 6d per £100). First block: 11 kWh a quarter for each farmhouse room, 165 kWh for farm buildings (max. power 10 kW) and 85 kWh for each additional 5 kW of max. power, 6d/kWh. Additional consumption, 1d/kWh. At present the first block (5d) consists of 10 kWh per room, 150 kWh for farm buildings up to 10 kW max. power and 75 kWh for each additional 5 kW; a second block (2½d) equal to the first; and additional consumption at 1d.

Restricted Hour Tariff.—The present tariff of 0·85d available for supplies between midnight and 7.30 a.m., noon and 3 p.m. and 6 p.m. and midnight, with unrestricted supplies at the week-ends, is withdrawn and two new tariffs are introduced. They are RH/1: 10 p.m. to 7 a.m. each day, 0·75d/kWh. RH/2: 8 p.m. to 7 a.m. and noon to 3 p.m. with unrestricted week-end supply from noon on Saturday, 0·85d/kWh.

The Eastern Electricity Board's recently opened Service Centre at Stevenage New Town. A glass panel let into the floor enables visitors to see the cables used for floor warming

OVERSEAS

No Reserve Capacity in Victoria

Because of the shortage of loan capital the construction programme of the State Electricity Commission of Victoria was limited last year to about £25 million. This problem was referred to by the chairman recently

when he reviewed the Commission's activities. He said that last winter they were again only just able to meet peak demands. "In all our planning the aim is to build up a reserve as soon as this can possibly be done," he said. "But the ever-present problem is how to obtain the necessary capital for a works programme that will be truly adequate to meet the State's expanding needs." One effect last year was that the Commission was obliged to increase electricity tariffs solely to raise additional capital.

Despite the shortage of capital, a 100 MW extension at Yallourn was now completed, except for some of the boiler plant, and work was begun on a further 240 MW extension to be known as Yallourn "E." This year a start is to be made on another large project, the Hazelwood power station, which may ultimately have a capacity of 1,000-1,200 MW. At the new Morwell briquette works the first of the two generators was ready for service and briquette production was expected to begin in a few months' time. Steady progress is being made with the latest works at Kiewa. This section consists of a hydro-electric power station 240ft long, nearly 80ft high and 45ft wide which is being built 250ft underground. Planned for completion in 1961, it will have a capacity of 96 MW.

During the year the agreement between the Commonwealth, New South Wales and Victorian Governments on the sharing of hydro-electric power and water from the Snowy Scheme was ratified. Victoria will be entitled to one-third and New South Wales two-thirds, after the Commonwealth has taken what power it needs for the Australian Capital Territory and within the Snowy Mountains area.

Work has just been completed on the 87-mile Colac-Melbourne section of the 220 kV grid which will ultimately encircle central Victoria. There are 250 miles already in service linking Yallourn, Melbourne and Kiewa, and another 188-mile section—from Kiewa to Sheparton and Bendigo—will be completed this year.

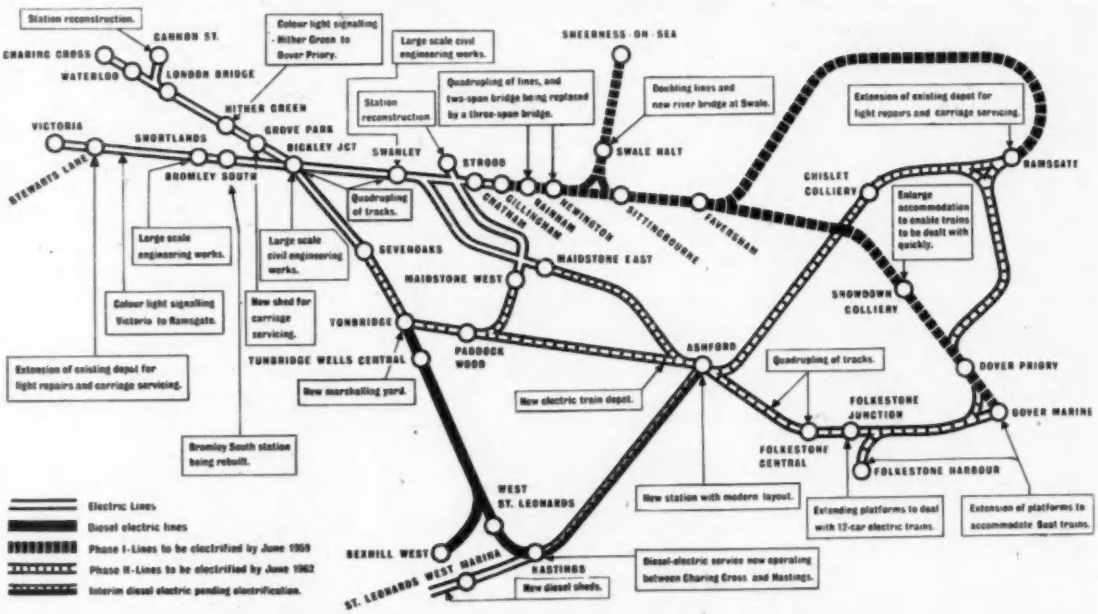
Electricity production throughout the State system during 1958 totalled 5,113 million kWh, 7 per cent more than in the previous year. The total installed capacity is 1,211 MW. Maximum demand on the interconnected generating system in July was 1,103 MW.

Uganda Output Expansion

Last year the Uganda Electricity Board generated a total of 278·4 million kWh compared with 148·8 million in 1957. This large increase—no less than 87 per cent—was due to the fact that the export of power to Kenya commenced at the beginning of the year, 90 million kWh being supplied. For Uganda alone, last year's expansion was equivalent to 26·6 per cent. There was a small falling off in the rate of growth between August and November and the total for the whole year, at 188·3 million kWh, was about 3·3 million below the estimated figure.

RAILWAY ELECTRIFICATION IN KENT

IN a pamphlet, "Transforming the Railway in the South-East," the Southern Region of British Railways gives details of the improved services which will be introduced when the first phase of the electrification is completed next June. A new traffic organisation, the South Eastern Division, has been set up to operate the lines, which are divided into four groups: those already electrified, covering the whole of the inner area and suburbs and extending as far as Gillingham and Maidstone; the London, Hastings and Bexhill line upon which diesel-electric trains have been introduced; the steam lines to be electrified, including the Kent Coast line to Sheerness, Ramsgate and Dover via Canterbury, and the main line through Folkestone to Dover; and a small group of branch lines, final decisions on which have not yet been made. Expresses will leave Victoria hourly between 7.40 a.m. and 10.40 p.m. for Ramsgate and Dover, running as one train as far as Gillingham and then dividing. There will also be semi-fast trains between Charing Cross and Ramsgate, and Victoria and Sheerness, with a through train service between Sheerness and Dover.

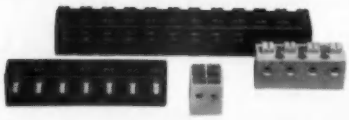


Map showing the work in progress on the electrification of Southern Region lines in Kent

NEW ELECTRICAL EQUIPMENT

Terminal Blocks

An agency has now been set up in this country for the range of "Suprafix" spring-loaded terminal blocks manufactured by Wago-Klemmenwerk G.m.b.H. The stripped cable end is inserted into the block after a button over the cable inlet is depressed, and the cable is securely held in position without damage by two serrated contact pads when the



Four types of "Suprafix" terminal block

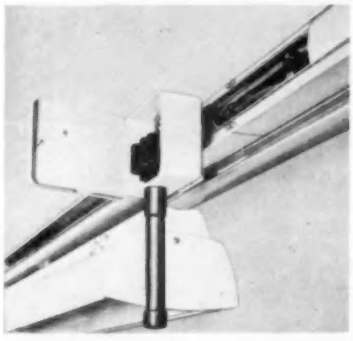
button is released. The block is vibration-proof and may be used with solid or stranded conductors having diameters up to $\frac{3}{32}$ in. Publication BH76 describing the blocks is available on application to the publications department, HELLERMANN, LTD., Crawley, Sussex.

Power and Communication Circuit Trunking

Trunking in which cables are placed in position with no drawing-in required and designed primarily for attachment to the existing "New Line" trunking, but which may also be fixed to walls or benches as an independent installation, has been introduced by CROMPTON PARKINSON, LTD., Crompton House, Aldwych, London, W.C.2. "Power Line" trunking consists of a channel manufactured in 15, 9 and 6ft lengths from 16 gauge rolled steel with a standard galvanised finish to give protection against moisture or damp atmospheres.

Earth bonding plates are supplied for use between lengths of trunking and snap-on plastic covers are provided to close the entry. Clamping plates are riveted to the channel during manufacture, spaced at 3ft 6in intervals, and screws in these plates interlock and secure the channelling and also make an earth continuity contact when it is supported by lighting trunking. Cable supports, pressed out from the clamping plates protruding into the channel, are fitted with plastic sleeves to protect the cables.

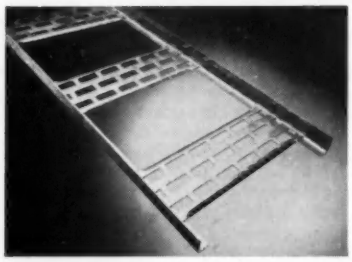
Up to eight 19/·064in taped, braided and compounded (t, b and c) or p.v.c. cables can be accommodated, and line taps are available for tap-off conductors up to 7/·036in. Pressed steel triple-pole and neutral fuse boxes finished in grey stove enamel are available, incorporating fuse units complete with h.r.c. cartridge fuses rated for 5, 10, 15, 20 and 30 A. Steel wire armoured cables may be introduced into the terminal boxes through suitable glands.



Crompton Parkinson "Power Line" trunking

Cable Tray

A lightweight cable tray enabling curves, corners, junctions and cross-overs to be readily made in any plane



Dexion "Viadex" cable tray

or direction and which can be fitted to walls, ceilings or other supports has been announced by DEXION, LTD., Maygrove Road, Kilburn, London, N.W.6. Cable laying in the new "Viadex" trays can be carried out entirely from the front using the associated cable clip and steel strapping. The cable clips produced for this tray may also be used on existing types of tray. The trays, which are supplied in 8ft lengths, are available in three widths, 3, 6 and 8in, with a galvanised finish if required.

Fused Spur Connector

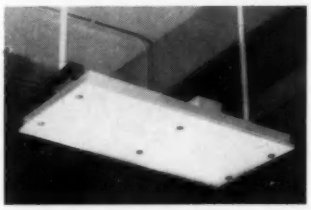
A 13 A fused spur connector (No. DE.1220) is the latest addition to the range of wiring accessories manufactured by NETTLE ACCESSORIES, LTD., Warren Street, Stockport, Cheshire. It enables fixed appliances with hidden wiring to be connected to a ring circuit as permitted under I.E.E. Wiring Regulation 114B. An easily removable fuse is contained in a fuse carrier which is secured to the cover by a screw. The base projection of the unit is sufficiently shallow to enable it to be wired into a 1in or $\frac{3}{4}$in internally deep box having BS. 1299 fixing centres.

Nettle Accessories 13A fused spur connector

The price, per dozen, is £4 4s in brown, and £4 8s in ivory.

Panel Heaters

Two high temperature radiant heat panels, in 750 and 1,500 W sizes, have been introduced by TYRAD ELECTRIC, LTD., Imperial Court, Basil Street, Knightsbridge, London, S.W.3. The panels can be suspended on chains or conduit and the average fixing height varies between 10 and 12ft. Heat is



Tyrad 1,500 W radiant panel heater

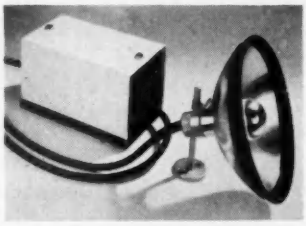
radiated from a steel face plate, finished in cream vitreous enamel, the mica-insulated heating element being sandwiched between the back of the plate and a layer of high temperature insulating material. The insulation and element are shrouded by a metal back plate which incorporates the terminal box.

The overall dimensions are 12$\frac{1}{2}$in square by 1$\frac{1}{2}$in deep (750 W), and 12$\frac{1}{2}$in by 24$\frac{1}{2}$in by 1$\frac{1}{2}$in deep (1,500 W). The respective weights are 7$\frac{1}{2}$ lb and 15$\frac{1}{4}$ lb and they are priced at £5 5s and £8.

Display Lighting Fittings

Two new display lighting fittings, small enough to be held in the palm of the hand yet claimed to be capable of producing light and colour of very high intensity, have been introduced by ATLAS LIGHTING, LTD., 233, Shaftesbury Avenue, London, W.C.2. Both use special low-voltage lamps to give the high intensities of light required, and they can be concealed in or behind display material so that the light source is undetectable.

The DA/0050 fitting has an adjustable lampholder concealed in a circular sleeve, mounted on a 4in pillar. Universal adjustment with positive



Atlas DB/0050 low voltage display fitting with transformer

locking is provided. The 12 V 50 W internally silvered sealed beam lamp used with the fitting gives a narrow soft edge beam of high intensity with a 20 deg spread, making it suitable for individual highlighting.

The second fitting, the DB/0050, has a 6in diameter polished anodised aluminium reflector mounted on a 4in pillar giving universal adjustment. The 12 V 50 W lamp used is internally silvered and only 38 mm in diameter. It throws a high intensity beam of some 200 ft-candles to a distance of 15ft and can be focused to give a splash of very concentrated light.

Both fittings are supplied fitted with 6ft lengths of circular flex for connection to a specially designed transformer unit. The transformer is finished in black and white and is available for 200/220 or 230/250 V. Literature giving full details and prices is available from the manufacturers.

Industrial X-ray Unit

The TF 1603 low-kV mobile X-ray unit, designed for radiography in the range 6 to 50 kV at 1 to 15 mA, is the latest addition to the range of industrial X-ray equipment manufactured by MARCONI INSTRUMENTS, LTD., St. Albans, Hertfordshire. The complete unit consists of a mobile stand on which are mounted the control unit, h.v. generator, adjustable tube mounting, h.v. cables, water hoses, water flow switch, and the shockproof X-ray tube.

Marconi mobile X-ray unit

The base of the unit carries a plinth for mounting the control unit and a vertical column and tubearm for mounting the tubehead, both being detachable for operation at a safe distance. The vertical X-ray tube carriage allows a floor-to-target distance varying from 16 to 70in, and the tubehead can be rotated allowing the beam to be directed at any angle. Housed within the plinth, the h.v. generator incorporates a vacuum oil-impregnated h.v. transformer and X-ray tube filament transformer, together with a 62·5 kV standard pattern h.v. socket. An effective focal spot size of 1·5 mm square has been selected to give fine radiographic detail, and a choice of tungsten, molybdenum or copper targets is offered.

Oil insulation is used, facilitating operation under moist and dusty conditions. Water cooling is employed and a pair of hoses, 10ft in length, is supplied. The control unit incorporates an auto-transformer, space charge compensation transformer, exposure contactors, and a static tube filament voltage stabiliser. Several ranges of timer are available.

New Season's Refrigerators

A new domestic refrigerator, the "Luxury Six" model D.671, has been added to the Prestcold range manufactured by the PRESSED STEEL CO., LTD., Cowley, Oxford. It has a capacity of 6·7 cu ft and its large shelf area of 11·7 sq ft provides ample storage room for the average household. There are three full-width shelves, two adjustable for height, and a side drop-down shelf at the top. A locker for frozen food storage is provided with trays for making ice cubes, and a large "crispator" for salads slides from beneath the bottom shelf.

The door is fitted with two shelves, two egg racks, each holding nine eggs, and a provisions compartment. A locking device is incorporated and two keys are provided. Interior lighting, concealed adjustable feet, and a gleaming finish in cream or white, are among its other attractions.

The refrigeration system is the hermetically sealed type and is guaranteed for five years. The cabinet is of all steel welded construction and measures 48⅜in high by 25⅜in square. The price, including purchase tax, is £102 18s.

The latest absorption type refrigerator to be announced by ELECTROLUX, LTD., 153, Regent Street, London, W.1, is a low priced family model which, although compactly planned with 5½ sq ft of shelf area, occupies surprisingly little kitchen space. It is the model L.26 and follows the styling of the company's model L.37, which was introduced last year. The new refrigerator has a capacity of 2·5 cu ft and the approximate dimensions are 2ft 8in high by 1ft 8¾in deep by 1ft 11¾in wide.

Electrolux 2·5 cu ft model L.26

Prestcold model D.671 "Luxury Six"

Four shelves are provided in the door of the refrigerator, one serving as an egg rack, and all can be removed for cleaning purposes. The upper shelf of the interior can accommodate nine pint bottles of milk at one time and frozen food can be kept in the ice compartment which normally holds a 14-cube ice tray.

The interior of the cabinet is in ice blue, with decoration in ice blue and gold, and the exterior is finished in white or cream enamel. A new type door catch with feather light closing is fitted and the handle is in resilient nylon.

The price of the model L.26 is £49 7s, including purchase tax.

Financial Section

STOCKS and SHARES

FOR the first time for many months there has been better support lately for Government stocks than for the industrial markets of the Stock Exchange. In the latter, buyers of ordinary shares have become noticeably more cautious about paying the highest prices ever recorded for most of the leading issues. At the same time, growing expectations of a further fall in interest rates have called attention to the relatively high yields still available on money invested in gilt-edged stocks. In reflection of this trend, the British Electricity stocks moved up further by amounts of up to 2 points, while industrial share prices again moved rather uncertainly at a level somewhat below the records recently established.

Irregular Changes

Very active dealings, again to a large extent on American account, produced some erratic swings in the price of Electric & Musical Industries 10s shares during the past week. Having risen in the first week of the year from 52s 6d to 61s 3d, with a peak price of 63s, the shares dropped at one time to 54s before picking up again to 57s 3d. Philips Lamps shares, which also have a large international following, were the subject of similarly large fluctuations before ending at 93s 3d. Generally, the net result of a reaction followed by recovery in the industrial market was a majority of minor losses in prices. Parsons, Reyrolle, Babcock & Wilcox, and Vactric all lost a shilling or so on balance, while there were smaller recessions in Crompton Parkinson, E. K. Cole, Bowthorpe, Aberdare and a number of others. In Chloride Electrical and Automatic Telephone, the reaction was rather larger. Shares to record improvements included Switchgear & Cowans, Brook Motors, Pye, and Telegraph Condenser. Greenwood & Batley have been marked up by no less than 25s, to 82s 6d, since the company declared a doubled interim dividend.

English Electric Issues

A large volume of business is passing in the new English Electric ordinary shares, of which some 1·8 million are offered to present shareholders at a price of 50s. Dealings have been taking place at a premium of a little under 10s. As is usual on the occasion of a cash issue on this scale, the rights are being sold in considerable numbers by members unable or unwilling to subscribe for their allotments, but against this is a substantial demand for the shares while they can be acquired free of the usual 2 per cent transfer stamp duty: they will remain so until the last call of 30s per share falls due on 10th March. The first instalment of 20s has to be paid by 27th January. At the all-in price of 59s 9d, there is a prospective yield of just on 4½ per cent on the shares.

T.C. & M. and B.I.C.C.

Shareholders of the Telegraph Construction & Maintenance Co. now have in their hands the formal offer (subject

Price Changes in

Company or Board	Nom. Value	Middle price 12th Jan.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield % £ s d	1958 Highest	1958 Lowest
Gilt-edged Stocks								
Brit. Elec. 1968/73	100	79½	+2	3	3	3 15 6	77	72
Brit. Elec. 1974/77	100	76½	+2	3	3	3 18 6	73½	68½
Brit. Elec. 1976/79	100	79	+1	3½	3½	4 8 6	78½	72
Brit. Elec. 1974/79	100	89½	+1	4½	4½	4 15 3	87½	82½
Overseas Electric Supply								
Calcutta Elec.	£1	16/6	−6d	6·8†	7†	14 15 0	17/6	15/-
East African Power	£1	22/6		7½	8	7 2 3	23/-	17/6
Nigerian Elec.	£1	14/-		10	10	14 5 6	17/-	12/6
Perak Hydro-Elec.	£1	13/6		12½	10	14 16 3	15/6	13/6
Electrical Shares								
Aberdare Holdings	5/-	15/-	−9d	17½	17½	5 16 9	15/9	9/9
Aerialite	1/-	8/-	−3d	51½	54	6 15 0	8/6	5/1
Allen, W H.	£1	43/9		10	11	5 0 6	43/9	32/9
Anglo-Portuguese Tel.	£1	27/9	+6d	8	9	6 9 9	29/3	19/9
Aron Elec. Ord.	£1	61/3		15	15	4 18 0	61/3	53/-
Assoc. Elec. Ord.	£1	57/6		15	15	5 4 3	58/9	46/6
Automatic Tel. & El.	£1	77/6	−2/6	17	17	4 7 9	75/-	57/-
Babcock & Wilcox	£1	49/3	−1/3	15	13‡	5 5 6	54/6	41/9
Bakelite	10/-	22/3	+6d	15	15	6 14 9	23/-	17/6
Baldwin, H. J.	2/-	2/6	−3d	20	20	—	3/9	2/6
Berry's Electric	5/-	11/-		10	10	4 11 0	11/3	5/9
Bowthorpe Holdings	2/-	12/3	−3d	37½	25*	4 1 9	11/9	6/6
British Aluminium	£1	83/-	+6d	12	12	—	78/3	37/-
British Elec. Traction: Def. Ord. "A"	5/-	36/6	−6d	25	25	3 8 6	40/-	19/6
B.I. Callender's	£1	48/9	−2/9	12½	12½	5 2 6	52/-	38/9
B.I. Callender's 6% Pref.	£1	20/-		6	6	6 0 0	20/3	19/-
British Tabulating	£1	62/6	+1/9	9	10	2 11 3*	60/-	30/9
British Thermostat	5/-	37/6		25	30	4 0 0	36/3	19/9
British Vac. Cleaner	5/-	4/9	+3d	10	10	5 5 3*	4/6	2/3
Brook Motors	10/-	48/9	+1/3	25	24½*	4 19 0	45/-	27/9
Bulgin, A. F.	1/-	7/-		40	45	6 8 6	7/-	4/7
Bulpitts	5/-	10/6	−3d	—	12½‡	5 19 0	11/-	7/3
Burco Dean	5/-	12/6	−3d	22½	16*	6 8 0	12/6	7/9
Cable & Wireless: Ord.	5/-	13/6	−3d	10	10‡*	3 14 0	13/-	8/-
4% Loan	100	94		4	4	4 5 0	94½	89
Chloride El. Storage "A"	£1	66/9	−3/3	17½	17½	5 4 9	68/9	55/6
Clarke Chapman	£1	62/6	+6d	27½	27½	4 8 0*	72/6	55/-
Cole, E. K.	5/-	19/3	−9d	17½	17½	4 11 0	18/-	15/3
Cossor, A. C.	5/-	6/9	−3d	2½	Nil	Nil	7/9	4/4
Crabtree	10/-	31/-		20	20	6 9 0	32/-	24/4
Crompton Parkinson	5/-	13/3	−6d	16	12*	4 10 6	13/9	8/3
Davis & Timmins	5/-	15/-		22½	18	6 0 0	16/3	10/3
De La Rue	10/-	32/9		35	17½*	5 6 9	34/-	20/9
Decca "A"	4/-	37/-		43½	43½	4 14 6	37/6	21/3
Desoutter	5/-	19/9		32½	18½*	4 15 0	19/3	13/6
Dewhurst	2/-	8/-	−3d	20	20	5 0 0	9/3	6/9
Dictograph Tel.	2/-	7/6		20	20	5 6 9	7/3	4/7
Dubilier Condenser	1/-	3/6		30	20*	5 14 3	4/3	3/1
Duport	5/-	10/3		25	12½*	6 2 0	10/9	7/9
E.M.I.	10/-	57/3	−4/-	15	20*‡	3 9 9	52/6	20/9
Electrical Components	5/-	10/9		12½	12½	5 16 3	10/9	7/-
Elec. Construction	£1	30/-		8½	8½	5 13 3	28/9	21/-
Elliott-Automation	5/-	18/3		—	10‡	2 14 9	19/9	11/6
Enfield Cable Ord.	£1	18/3	−6d	Nil	2½	2 14 9	18/9	10/9
English Electric	£1	59/6	+6d	14	14	4 14 0	60/-	44/-
English Electric 3½% Pref.	£1	12/6		3½	3½	6 0 0	12/6	11/9
Ericsson Tel.	5/-	26/9		22†	12*‡	3 17 6	26/3	17/6
Ever Ready	5/-	22/3		37½	20*	4 10 0	22/3	13/9
Falk Stadelmann	£1	43/9		17½	15	6 17 3	46/3	35/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

to certain conditions) of an exchange into B.I.C.C. shares, in the proportion of one of the latter company's 5½ per cent preference shares for each Telcon 5 per cent preference share, and three ordinary for every four Telcon ordinary shares. Acceptance has to be notified by 7th February and is recommended by the directors. To illustrate the effect of the proposals, Telcon give figures showing that at the prices ruling just before the initial announcement, the exchange would produce an improvement in the market value, based on 100 Telcon ordinary shares, from £165 to £187 10s, and in prospective income from £8 10s to £9 7s 6d per annum. The prices of both shares have receded a little lately.

Cable Shares

In connection with other merger negotiations now in progress, A.E.I. have called a meeting for 23rd January to sanction the increase in capital necessary to accommodate the acquisition of the London Electric Wire Co. & Smiths' share capital. The offer is of five A.E.I. ordinary shares for each four L.E.W. ordinary, plus 4s cash for each L.E.W. share. L.E.W. have now declared a second dividend for the year making a total of 15 per cent, which is also the rate expected from A.E.I. Recently the prices of both shares have been fairly steady at 57s 6d for A.E.I. and 73s for L.E.W.; the latter stand about 13s above the quotation ruling shortly before the announcement of the proposals. Activity in the shares of other cable manufacturing companies, including Johnson & Phillips, Scottish Cables and Enfield, has remained above normal.

Thorn Electrical

As a result of the steady rise in the price of Thorn Electrical Industries 5s ordinary shares, now quoted at 27s 6d and 24s 6d for the "A" shares, the yield on the basis of the 17½ per cent dividend paid for 1957–58 is now no higher than 3½ per cent, which marks them as one of the most favoured "growth" stocks in the electrical market. Since the recent announcement of negotiations between the company and the Philco Corporation of America, comment on the shares has been stressing the significance of the company's transatlantic connections, notably the long-standing link with the Sylvania Electric Products Co. of New York. That enterprise is reported now to be arranging a merger with the General Telephone Co.

British Aluminium and T.I.

The battle for British Aluminium was virtually ended by the announcement that the Tube Investments group had already acquired over 80 per cent of the ordinary shares, and by the assumption that the American interests would withdraw from the field. At this point, Tube Investments £1 shares stood at 76s. They were 77s 6d before the company's entry into the struggle, and have been up to 86s during the course of it. Dealings in British Aluminium shares were expected to start this week in two forms, one for shares on which assent had been signified to the T.I. offer, and the other for "unassented" shares. The last date for assent has been extended to 27th January, by which time it is thought likely that few B.A. shareholders will have failed to accept the offer of 88s cash, and one T.I. share, for every two B.A. shares.

Electrical Investments

Company or Board	Nom. Value	Middle price 12th Jan.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield % £ s d	1958 Highest	1958 Lowest
Electrical Shares—continued								
G.E.C.	£1	38/9	−3d	12½	10	5 3 3	40/-	29/3
G.E.C. 6½% Pref.	£1	21/-		6½	6½	6 3 9	21/6	20/3
General Cables	5/-	8/9		24	15	8 11 6	11/9	8/3
Greenwood & Batley	£1	82/6	+25/-	17½	20	4 17 0	57/6	45/-
Hackbridge Holdings	5/-	14/9	−6d	20	20	6 15 6	15/3	7/6
Hackbridge & Hewittic	5/-	14/-		20	20	7 2 9	14/6	9/7
Head Wrightson	5/-	24/9	−6d	22½	17½*	3 10 9	26/-	16/9
Heatrae	2/-	7/9		15	20	5 3 3	7/9	4/-
Holophane	5/-	15/6		37½	22½*	7 5 3	15/6	12/6
Hoover	5/-	58/-	−6d	50	50	4 6 3	58/6	31/-
I.C.I.	£1	36/-	−9d	10	12	4 9 0*	37/6	23/9
Intl. Combustion	5/-	30/9		22½	25	4 1 3	28/3	19/3
Johnson & Phillips	£1	26/9	−1/6	10	5	3 14 9	25/-	15/-
Lancashire Dynamo	£1	45/-		11	11	4 17 9	45/-	28/6
Laurence Scott	5/-	16/9		15	15	4 9 6	16/9	12/6
Lister, R. A.	£1	34/-		10	12½	7 7 0	34/6	23/-
London Elec. Wire	£1	73/-	−9d	12½	12½	—	72/-	39/6
Lucas, J.	£1	44/6	−3d	7½	10‡	4 10 0	45/-	27/9
Marconi Marine	£1	41/3		10	10	4 17 0	40/-	29/-
Marryat & Scott	2/-	9/-	+3d	35	37½	4 3 3*	8/9	5/3
Mather & Platt	£1	50/6	+6d	15	15	3 19 3*	50/6	29/6
Metal Industries	£1	40/6	−2/6	9	14	6 18 3	44/-	22/9
Midland Elec. Mfg.	£1	42/6		12½	10*‡	4 14 3	41/3	26/6
Morphy-Richards	4/-	19/-	−1/-	20	20	4 4 3	20/-	14/6
Murex	£1	44/3	−1/6	20	17½	7 18 3	59/3	46/9
Newman Ind.	2/-	2/9		10	10	7 5 6	2/9	2/3
Oldham & Son	1/-	2/9		17½	17½	6 7 3	3/-	2/3
Parsons, C. A.	£1	53/9	−1/3	8½	7½*	2 15 9	55/-	43/-
Plessey	10/-	72/6		30	30	4 2 9	72/6	55/-
Pye	5/-	15/6	+6d	12½	12½	4 0 9	17/-	10/-
Pyrotenax	5/-	35/3	−2/6	—	27½‡	3 18 0	37/-	27/6
Reyrolle	£1	96/3	−1/3	17½	17½	3 12 9	93/9	73/6
Rheostatic	4/-	9/-	−6d	12½	12½	5 11 0	8/6	6/-
Richardsons Westgarth	10/-	14/3		16½	8½*	5 17 0	15/9	13/-
Scottish Cables	4/-	15/3	+1/6	27½	27½	4 3 9*	12/3	7/-
Simon-Carves	5/-	31/3		20	25	4 0 0	31/3	22/6
Smith (England), S.	4/-	12/-		20	12½*‡	4 3 3	12/3	7/-
Southern Areas	£1	12/-		7½	Nil	Nil	13/9	9/3
Strand Elec.	5/-	8/9		15	15	8 11 6	9/3	4/9
Sturtevant	5/-	17/3	−3d	15†	15†	7 12 0	19/6	14/9
Sun Elec.	£1	61/9		25	25	8 2 0	60/6	47/3
Switchgear & Cowans	5/-	11/-	+6d	25	22½	5 2 3*	9/9	4/6
Taylor Tunnicliff	5/-	18/3		15	17½	4 16 0	18/3	11/9
T.C.C.	10/-	40/-	+1/-	25	25	6 5 0	38/6	32/6
T.C. & M.	£1	34/6	−1/6	8½	8½‡	—	37/-	20/-
Telephone Mfg.	5/-	5/-		10	10	10 0 0	5/9	4/3
Telephone Rentals	5/-	14/3	−6d	12½	12½	—	14/6	9/9
Thompson (John)	5/-	24/3	−3d	25	25	5 3 0	27/-	23/-
Thorn Elec. "A"	5/-	24/6	−6d	17½	17½	3 11 6	25/-	17/-
Thornycroft	£1	22/6		12½	7½	6 13 3	30/9	21/-
Tube Investments	£1	76/-	−2/3	15	17½	4 12 0	81/3	48/3
Vactric	5/-	31/3	−1/3	25	25	3 17 0	—	—
Veritys	5/-	3/9	−1/6	12½	2½	3 6 9	6/9	5/3
Walsall Conduits	4/-	18/3		20	22½	4 18 9	18/3	11/-
Ward & Goldstone	5/-	36/6		40	25*	3 8 6	37/-	23/6
Watford	2/-	7/9	−3d	25	25	5 3 3*	8/-	4/-
Westinghouse	£1	45/-	−1/3	10	10	4 9 0	45/-	32/3
West, Allen	5/-	12/9	−9d	15	12½*	4 11 6‡	13/3	7/9
Wolf Electric	5/-	8/-		20	10*	6 5 0	9/-	6/9

REPORTS and DIVIDENDS

B.I.C.C. and Telcon.—In connection with the offer by British Insulated Callender's Cables, Ltd., to purchase the whole of the preference and ordinary shares of the Telegraph Construction & Maintenance Co., Ltd. (*Electrical Review*, 12th December, p. 1116), an extraordinary meeting of B.I.C.C. will be held on 23rd January at which proposals will be submitted for increasing the capital by the creation of 500,000 new second cumulative preference shares of £1 each and an additional 2,500,000 ordinary shares of £1 each.

Associated Electrical Industries, Ltd., is holding an extraordinary meeting on 23rd January to authorise an increase in the capital to £48·7 million by the creation of 3,700,000 unclassified shares of £1 each for the purpose of acquiring the whole of the issued share capital of the London Electric Wire Co. & Smiths, Ltd. Details of the A.E.I. offer for the L.E.W. share capital were given in our issue of 2nd January.

The London Electric Wire Co. & Smiths, Ltd., has announced that, as intimated with the merger offer by Associated Electrical Industries, Ltd., it is paying a second interim dividend of 10 per cent (against 8¾ per cent), making 15 per cent for 1958 (against 12½ per cent for the previous year).

British Aluminium Co., Ltd.—It was announced by Tube Investments, Ltd., last Monday that Tube Investments and Reynolds Metals now hold 87½ per cent of the total issued ordinary capital of the British Aluminium Co., Ltd. The Aluminum Co. of America indicated that it was no longer interested in the venture with British Aluminium if control passed to T.I.-Reynolds.

At the extraordinary meeting of Tube Investments, Ltd., on Monday resolutions were passed authorising an increase in the capital by £4,250,000 to £27,250,000.

Marco Refrigerators, Ltd., reports a profit for the year ended 30th September of £26,423, after deducting £25,854 for taxation. This compares with a profit of £18,993 for the preceding year. It is proposed to pay a final dividend of 8½ per cent (against 6¼ per cent), making 11 per cent (8¾ per cent) for the year. The balance carried forward is £56,466 (against £47,153 brought in).

Radio Rentals, Ltd.—London and Yorkshire Trust announces on behalf of Radio Rentals that the consent of the Treasury has been received to an issue of 1,600,000 ordinary shares of 5s each for cash at 15s per share. It is proposed to offer these shares to ordinary shareholders in the proportion of one new share for every five ordinary shares held.

The main figures in the accounts for the year ended 31st August last were given in our issue of 26th December. In his statement which accompanies the report and accounts now issued, Mr. P. Perring-Thoms (chairman and managing director) says that during the year there was an increase of 15 per cent over the previous year in the number of new television sets installed. Mains Radio Gramophones, Ltd., the main subsidiary company, has achieved a new record level of production. During the four months ended 31st December last, Government controls on renting and hire-purchase were completely removed in two stages. This has had a stimulating effect on their trading, particularly on the television rental side of the business. Whilst they have welcomed the return to free trading conditions, they recognise that the present high peak of public demand will level off in due course.

Greenwood & Batley, Ltd., have declared an interim dividend of 10 per cent (against 5 per cent).

New Companies

Neco Motor Repairs, Ltd.—Registered 1st January. Capital £1,000. To establish or acquire and carry on in England or elsewhere, the business of assemblers or repairers of electrical equipment manufactured or sold by the Normand Electrical Co., Ltd., etc. Directors: W. Scott, J. W. Bowdage and J. E. Wright. Regd. office: 204, Queenstown Road, S.W.8.

Sweetnam & Bradley, Ltd.—Registered 3rd November. Capital £6,600. Electrical engineers, general electrical and refrigeration contractors, etc. Directors: J. D. Sweetnam and A. C. E. Bradley. Regd. office: Bremilham Works, Bristol Road, Malmesbury.

Radlec, Ltd.—Registered 5th November. Capital £500. Designers, manufacturers of and dealers in electrical appliances, domestic equipment, etc. Directors: H. U. Griffiths and Elsie K. Griffiths. Regd. office: High Green, Brewood, Staffs.

Telemike, Ltd.—Registered in Edinburgh 28th October. Capital £750. Manufacturers of and dealers in electrical and other instruments for radio telegraphy and telephony, etc. Directors: F. Sammercroff, M. McManus and L. Sammercroff. Regd. office: 175, St. Vincent Street, Glasgow.

Brash & Clanford, Ltd.—Registered 5th November. Capital £100. Manufacturers and distributors of, agents for and dealers in, hirers out and repairers of electrical goods of all kinds, etc. Directors: S. B. Brash and L. Clanford. Regd. office: 20, Notting Hill Gate, W.11.

Large Electrical Co., Ltd.—Registered 7th November. Capital £1,000. Electricians, electrical contractors and engineers, radio and television engineers, etc. Directors: J. W. McLeod and K. M. Briggs. Regd. office: 35, Brecknock Road, N.7.

S.P. Supplies, Ltd.—Registered 7th November. Capital £1,000. Manufacturers of and dealers in electrical goods of all kinds, etc. Directors: P. Sheppard and Mrs. Joyce M. Sheppard. Regd. office: 121, Lee Road, Blackheath, S.E.3.

Buck & Watts (Electronics), Ltd.—Registered 13th November. Capital £2,000. To acquire the business of dealers in electrical goods heretofore carried on by Buck & Watts (Electronics) at 256, Milton Road, Weston-super-Mare, etc. Directors: A. A. Buck and D. G. Watts. Regd. office: 256, Milton Road, Weston-super-Mare.

Finsbury Trading (London), Ltd.—Registered 18th November. Capital £1,000. Manufacturers of and dealers in electrical goods of all kinds, etc. Directors: B. Lerner and Mrs. Etelka Lerner. Regd. office: 2, Glaserton Road, N.16.

T. W. Hughes & Co., Ltd.—Registered 22nd December. Capital £100. Electrical contractors, manufacturers, hirers, letters on hire, servicers, maintainers and repairers of and dealers in electrical, electronic, radar, radio, television and telephone apparatus, etc. Directors: H. C. Williams (permanent), T. I. Jones and T. W. Hughes. Regd. office: Midland Bank Chambers, Mostyn Street, Llandudno.

Alan Woodward & Co., Ltd.—Registered 24th December. Capital £4,000. Electrical engineers, household suppliers, general electrical and refrigeration installation contractors, etc. Directors: A. F. Woodward and K. A. Woodward. Regd. office: 14, St. Ebbes Street, Oxford.

Penzance Radio, Ltd.—Registered 24th December. Capital £2,500. Manufacturers and repairers of and dealers in artificial lighting apparatus, electrical plant, machinery fittings and accessories, wireless and television sets, etc. Directors: T. A. Bent and L. G. Ashton. Regd. office: 88, Cornwall Street, Plymouth.

Knight Electrics (Neon), Ltd.—Registered 19th December. Capital £1,000. Manufacturers of and dealers in neon advertising and lighting signs, etc. Directors: G. J. Burtenshaw, C. H. Roberts and R. A. Raphael. Regd. office: 54, Alsen Road, N.7.

Tele-Radio (Blackburn), Ltd.—Registered 24th December. Capital £1,000. Manufacturers of and dealers in electrical appliances, etc. Directors: H. Hopwood and Audrey Hopwood. Regd. office: 86, Bolton Road, Blackburn.

O. C. Nye & Co., Ltd.—Registered 23rd December. Capital £5,000. To acquire the business of an electrical engineer carried on by O. C. Nye at Stevenage, etc. Directors: O. C. Nye, Mrs. Winifred Nye and A. Skeet. Solicitors: Brignall, White & Orchard, Stevenage, Herts.

Arthur McKay & Co. (Electrical Contractors), Ltd.—Registered 2nd December in Edinburgh. Capital £100. Electricians, electrical engineers, etc. Directors: A. McKay and J. Macleod. Regd. office: 10a, Young Street Lane South, Edinburgh.

Ladybird Electric Motors, Ltd.—Registered 30th December. Capital £5,000. To acquire the business of manufacturers of and dealers in electric motors now carried on by J. W. Horwood and Ivy M. Horwood at Trinity Street, Halstead, Essex, as "Landus Products," etc. Directors: H. H. Hemming, F. P. Leaman, J. W. Horwood and Mrs. Ivy M. Horwood. Regd. office: 3, Clement's Inn, W.C.2.

Northern (Neon) Lights, Blackpool, Ltd.—Registered 24th December. Capital £500. Manufacturers and repairers of and wholesale and retail dealers in neon lights, neon letters, neon and other electric signs, etc. Directors: H. E. Cockerill (managing director) and W. Baines. Regd. office: 14, Edward Street, Blackpool.

E. R. Redcliffe (Fittings), Ltd.—Registered 23rd December. Capital £200. Manufacturers of and dealers in electrical goods, etc. Directors: E. R. Redcliffe and Maud F. Redcliffe. Regd. office: 2, Station Road, E.4.

G. Tregoning, Ltd.—Registered 11th December. Capital £2,000. Electrical engineers, etc. Directors: J. E. Tregoning and W. D. Willis. Regd. office. 12, East Parade, Bishop Auckland.

A. R. Good (Electronics), Ltd.—Registered 11th December. Capital £5,000. Directors: Mrs. Olga Clarke and A. R. Good. Regd. office: Surrey House, Surrey Street, Croydon.

Neotronics, Ltd.—Registered 11th December. Capital £1,000. Manufacturers, repairers and conditioners of cathode ray tubes, etc. Directors: R. C. Shiers, T. C. Huggett and H. T. Willoughby. Regd. office: 25, Harley Street, W.1.

Willcocks Electrics, Ltd.—Registered 15th December. Capital £5,000. Electrical engi-

neers and contractors, etc. Solicitors: Bond, Pearce, Elliott & Knape, Plymouth.

Scull Electrical, Ltd.—Registered 17th December. Capital £15,000. Electrical and mechanical engineers, etc. Directors: A. A. Scull, R. L. Bell, L. M. West and G. E. Wild. Regd. office: 3/4, Prince's Buildings, Clifton, Bristol, 8.

R. H. Treble (Electrical), Ltd.—Registered 16th December. Capital £1,000. Electrical engineers and contractors, etc. Directors: R. H. H. Treble, Lilian M. Treble and B. R. Simmons. Regd. office: 29, Merlin Road, Chase Cross Road, North Romford, Essex.

Camm Electrical Wholesalers, Ltd.—Registered 12th December. Capital £15,000. Electricians, electrical contractors, electrical and mechanical engineers, television and radio engineers, etc. Directors: J. E. Moxon and J. A. Connor. Regd. office: Camm House, New Hill, Conisborough, near Doncaster.

Hartfield Electrical Equipment Co., Ltd.—Registered 12th December. Capital £2,000. Buyers and sellers of, dealers in and manufacturers of electrical and electronic apparatus, etc. Directors: H. C. Galustian and Mrs. Helen Galustian. Regd. office: 17, Hartfield Road, S.W.19.

Cable Markers, Ltd.—Registered 15th December. Capital £1,000. Manufacturers of and dealers in electrical apparatus, fittings, accessories, etc. Directors: A. Stephens and S. J. Snelling. Regd. office: 107, Gales Drive, Three Bridges, Sussex.

Frank Fish, Ltd.—Registered 9th December. Capital £1,000. Manufacturers of and dealers in electrical apparatus, electric lighting systems, power systems, etc. Directors: F. Fish and Mrs. Edith A. Fish. Regd. office: 52, Hollins Grove Street, Darwen.

Increases of Capital

Solartron Electronic Group, Ltd.—Increased by £200,000 in 400,000 ordinary shares of 10s each, beyond the registered capital of £250,000.

Colvern, Ltd.—Increased by £150,000 in £1 8 per cent cumulative preference shares, beyond the registered capital of £250,000.

Bankruptcies

M. Neidle, lately trading at 26, Elmer Gardens, Edgware, Middx., as an electrical contractor.—Trustee, Mr. A. J. Cooke, 4, Tokenhouse Buildings, King's Arms Yard, Moorgate, London, E.C.2, appointed 18th December.

R. H. Winslade, 7, Collingwood Mount, Portsmouth Road, Camberley, Surrey, electrical engineer.—Application for discharge to be heard on 27th January at the Guildhall, Guildford.

G. A. Adams, 51, Hollyfaste Road, Sheldon, Birmingham, motor body builder inspector, previously carrying on business at first in partnership with another at 90, Jamaica Row, Birmingham, and latterly from 1, Ings Road, Wombwell, East Riding, Yorks., also under the style of Electro-Neon Lighting Co., electrical contractor.—Trustee, Mr. W. H. Haigh, Somerset House, 37, Temple Street, Birmingham, 2, Official Receiver, released 30th December.

F. Simons, 15, The Council House, Winchcombe Road, Sedgeberrow, Evesham, Worcs., electrical contractor.—Last day for receiving proofs for dividend 22nd January. Trustee, Mr. R. F. Bendall, 126, Colmore Row, Birmingham, 3.

H. Smith, lately carrying on business as an electrical engineer at The Old Bakery, South Clifton, Notts.—First and final dividend of 1s 9d in the £, payable at 185, High Street, Lincoln.

Liquidation

E. & W. Smith (Electrical Engineers), Ltd.—Creditors' voluntary winding-up. Meetings 9th February at the offices of Poppleton & Appleby, 31, Lloyd Street, Manchester, 2, to receive an account of the winding-up by the liquidator, Mr. L. H. Shipton.

Statement on Veritys' Affairs

In a circular to stockholders of Veritys, Ltd., issued last week, Mr. R. M. Mair (chairman) sets out the circumstances which led to the Midland Bank's winding-up petition. He refers to the removal of the business from Aston to Stirchley, Birmingham, and states that it was expected that the proceeds from the sale of the Aston works would finance removal costs, the cost of installing plant on efficient and modern production lines and capital expenditure in respect of modernisation. Unfortunately the Aston works failed to reach the reserve at an auction in June last. The cost of the removal and the capital expenditure involved in connection with additional plant and modernisation proved heavier than was anticipated and in addition, partly owing to the disorganisation resulting from the removal and partly owing to the improvement in the order book not becoming effective by the end of the year, the company sustained a heavy loss in the year which has just closed.

The services of Mr. W. G. A. Russell, of Russell, Durie Kerr Watson & Co., were secured to review the position and advise on the best course of action. His report showed that on 30th November the company was indebted to its bankers for approximately £166,000 and to trade and other creditors for approximately £224,000, in addition to a deferred liability of £20,000 by way of premium on the lease of the new works. Payments to trade and other creditors were then up to seven months in arrear. Against these liabilities, available liquid assets at 30th November were accounts receivable of approximately £129,000 and stock and work-in-progress estimated to be worth at cost approximately £260,000. Mr. Russell emphasised that these figures could only be regarded as approximate.

The remaining capital of the business was represented by the freehold works at Aston and by the plant, machinery and other fixed assets. The directors' borrowing powers under the company's articles were limited to the amount of its issued capital, £180,000, and no increase could be made in this figure without obtaining stockholders' sanction.

On 30th December the company's bankers demanded immediate repayment of the overdraft of £167,860 and later presented a winding-up petition and also applied to the court for either Mr. Russell or the Official Receiver to be appointed as a provisional liquidator.

Mr. Mair assures stockholders that the board is anxious to do everything possible to preserve the business with a view to sale at the best possible price. In the circumstances the directors feel that they should approve the appointment of Mr. Russell as a provisional liquidator, as he will, it is hoped, have the necessary authority not only to preserve the assets but to continue trading in the meantime with a view to sale on the most advantageous terms possible.

The petition presented to the High Court by the Midland Bank for the winding up of the company will be heard in London on 19th January.

CATALOGUES AND LISTS

CABLES.—60-page booklet (541) dealing with oil-filled cables.—**W. T. Henley's Telegraph Works Co., Ltd.,** 51-53, Hatton Garden, London, E.C.1.

COMPUTER EQUIPMENT. — 12-page catalogue (DC.37) dealing with magnetic drums, and a folder (DC.33) describing the TR5 transistorised tape reader.—**Ferranti, Ltd.,** Hollinwood, Lancs.

INSTRUMENTS.—Two leaflets dealing with a test set giving a wide range of high resistance measurements, and a thermocouple test set which provides all the facilities for testing thermocouples and their associated indicators.—**W. G. Pye & Co., Ltd.,** Granta Works, Cambridge.

LIGHTING.—Booklet illustrating examples of lighting installations using "Modulume" luminous ceilings.—**Crompton Parkinson, Ltd.,** Crompton House, Aldwych, London, W.C.2.

Design Bulletin (No. 3) dealing with ceiling lighting.—**Philips Electrical, Ltd.,** Century House, Shaftesbury Avenue, London, W.C.2.

LIGHTING FITTINGS.—Price list giving the latest figures for the lighting fittings illustrated in the company's various catalogues and lists.—**Watertight Fittings, Ltd.,** Victory Works, 4-10, Newbold Road, Chesterfield.

MOTOR CONTROL GEAR.—Brochure giving particulars and illustrations of the various types of motor control gear produced by the company.—**Brook Motors, Ltd.,** Empress Works, Huddersfield.

OIL BURNER CONTROLS.—Catalogues (E-CF.21 and E-CF.33) dealing with flame failure safeguard and programming control equipment designed for use with automatic burners.—**Fireye Controls Co., Ltd.,** 14, Fetter Lane, London, E.C.4.

REFRIGERATORS.—9in by 12in wall chart showing diagrammatically the basic principles of the hermetically sealed system fitted to Hotpoint domestic refrigerators.—**A.E.I.-Hotpoint, Ltd.,** 33, Grosvenor Place, London, S.W.1.

SOLENOID VALVES.—Descriptive folder (301) covering solenoid operated semi-balanced heavy duty valves designed for the control of fluids, including gases, in industrial processes.—**Jones, Tate & Co., Ltd.,** Victory Works, East Parade, Bradford, 1.

SPACE HEATING.—Brochure describing "Onazote" perimeter insulation for electric floor heating installations.—**Expanded Plastics, Ltd.,** 675, Mitcham Road, Croydon.

Broadsheet giving particulars, prices and illustrations of the company's range of space heating equipment.—**Unity Heating, Ltd.,** Chilworth Manor, Southampton, Hants.

Leaflet giving particulars of the "Stovec" combined direct and storage type space heater.—**Heatovent Electric, Ltd.,** Lomond Street, Glasgow, N.2.

WIRES.—Descriptive folders giving particulars of thermocouple wires and compensating leads, and copper braids, cords and sleevings.—**Saxonia Electrical Wire Co., Ltd.,** Roan Works, Greenwich, London, S.E.10.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2

1953

1411. Standard Telephones & Cables, Ltd.—Telegraph systems. 16th January, 1953. (807500.)

1954

11391/2/3. Walter Instruments, Ltd.—Magnetic sound recording and reproducing apparatus. 20th April, 1955. (807435/6/7.)

12205. Gresham Transformers, Ltd.—Potted electrical apparatus. 26th April, 1955. (807262.)

13326. Electric & Musical Industries, Ltd.—Focusing arrangements for image pick-up tubes. 3rd May, 1955. (807301.)

14569. Fenn, L. E.—Electric cigar or cigarette lighters. 21st April, 1955. (807440.)

14634. Electric & Musical Industries, Ltd.—Reflex klystron devices and hollow electrical resonators therefor. 9th May, 1955. (807542.)

23838. Philips Electrical Industries, Ltd.—Electric voltage measuring circuit arrangements. 5th July, 1955. (807373.)

26430. West & Co., Ltd., A., and Pavitt, F. J.—Delayed action electromagnetic actuating devices, particularly for electromagnetic contactors. 12th August, 1955. (807331.)

29821. British Central Electrical Co., Ltd., and Malkin, G. C.—Instruments for testing for earthing faults in electric circuits. 16th January, 1956. (807544.)

32551. English Electric Co., Ltd.—Oil-filled electric circuit-breakers. 4th November, 1955. (807264.)

1955

5. Hulbert C. Lacy-.—Snap-action electric switches. 29th December, 1955. (807522.)

4332. British Thomson-Houston Co., Ltd.—Electric motor control systems. 10th February, 1956. (807265.)

5500. Telemecanique Electrique.—Arrangement of opening compartments intended to house electrical apparatus mounted on movable frames. 23rd February, 1955. (807266.)

14659. General Electric Co.—Securing means for blading of compressors or turbines. 20th May, 1955. (807231.)

18053. Graviner Manufacturing Co., Ltd., and Wilkinson Sword, Ltd.—Electrically operated indicators. 21st September, 1956. (807333.)

19373. Vanderhoof, A. S.—Rectifier assembly. 5th July, 1955. (807510.)

23102. Radio Corporation of America.—Phase controlled semi-conductor oscillator. 10th August, 1955. (807513.)

24354. Metropolitan-Vickers Electrical Co., Ltd.—Multi-break electrical switches. 24th August, 1955. (807551.)

28294. United-Carr Fastener Corporation.—Connectors and electrical assemblies including same. 4th October, 1955. (807335.)

29766. General Electric Co., Ltd., and Bennett, W. E.—Electric delay lines. 17th October, 1956. (807309.)

31063. Igranic Electric Co., Ltd.—Protection and control system for synchronous motors. 31st October, 1955. (807518.)

31428. Ensylon Research & Development Co., Ltd.—Waveguides. 4th February, 1957. (807465.)

34315. General Electric Co.—Insulated coatings for magnetic sheet material. 30th November, 1955. (807527.)

35008. Marconi Italiana.—Automatic radio tuning devices. 6th December, 1955. (807340.)

35974. Santon, Ltd.—Electric immersion heaters. 17th December, 1956. (Addition to 722220.) (807556.)

36368. Siemens Edison Swan, Ltd.—Electrical impulse counters. 17th December, 1956. (807528.)

36411. Smith, Ltd., H.—Electric conduits. 18th December, 1956. (807341.)

1956

319. General Electric Co., Ltd.—Apparatus of the kind including a waveguide. 31st December, 1956. (807557.)

3642. Reumerman, T., and Helmig, W. H. T.—Translation of symbols into electric signals. 31st January, 1957. (807343.)

4506. Kelvin & Hughes, Ltd.—Servo systems. 25th January, 1957. (807313.)

5257. Watt, F. P.—Prepayment gas and electric meters. 8th May, 1957. (807344.)

8135. General Electric Co.—Photosensitive apparatus. 15th March, 1956. (807450.)

8726. Wipac Development, Ltd.—Permanent magnet alternators. 13th March, 1957. (807467.)

8836. General Electric Co.—Electrical component carriers. 21st March, 1956. (807279.)

9376. Decca Record Co., Ltd.—Electrical waveform generators. 18th March, 1957. (807426.)

13908. General Electric Co., Ltd.—Elements for high rupturing capacity electrical fuses. 3rd May, 1957. (807347.)

14231. Babcock & Wilcox, Ltd.—Tubulous vapour generating and vapour heating units. 7th May, 1957. (807282.)

14295. Sylvania Electric Products, Inc.—Colour television mask positioning and support assembly. 8th May, 1956. (807349.)

16917. Brake, L. H.—Electrically heated mattresses and the like. 31st May, 1956. (807350.)

17351. British Thomson-Houston Co., Ltd.—Magnetic storage systems. 20th June, 1957. (807379.)

17522. Sylvania Electric Products, Inc.—Lamp carrying head for an electric lamp-making machine. 6th June, 1956. (807473.)

18007. Central Electricity Generating Board and Hasler, E. F.—Construction of electrical equipment. 7th June, 1957. (807380.)

20568. Telephone Manufacturing Co., Ltd.—Electrical capacitors. 10th May, 1957. (807475.)

21051. British Thomson-Houston Co., Ltd.—Large transformer cores. 19th June, 1957. (807352.)

21613. Electroflo Meters Co., Ltd.—Recording instruments and charts therefor. 12th July, 1957. (807568.)

23752. Upton, R. C., Upton, N. W., Harper, J. E., Bassett, L., Davis, W. L., and Williams, B. I. (trading as Upton Electric Furnace Co.).—Fused bath electrical furnace. 1st August, 1956. (807476.)

24557. Philips Electrical Industries, Ltd.—Push-button operated switching devices, more particularly for use in radio receivers. 10th August, 1956. (807286.)

27102. United Kingdom Atomic Energy Authority.—Scintillators. 28th August, 1957. (807570.)

27780. Siemens & Halske A.G.—Travelling wave tubes. 11th September, 1956. (807357.)

28724. Automatic Telephone & Electric Co., Ltd.—Silvered mica capacitors. 8th August, 1957. (807480.)

33517. Philips Electrical Industries, Ltd.—Methods of providing electrical components having a tubular body of dielectric or semi-conductive material with connecting leads. 2nd November, 1956. (807361.)

34994. Lembke, I. C., and Wilson, C. W.—Fluid-pressure actuated electric switch mechanism. 15th November, 1956. (807252.)

35405. Marconi's Wireless Telegraph Co., Ltd.—Radar reflectors. 6th August, 1957. (807362.)

36158. British Oxygen Co., Ltd.—Electric arc welding of pure metals or alloys. 26th November, 1956. (807289.)

37036. Philips Electrical Industries, Ltd.—Television arrangements. 4th December, 1956. (807291.)

1957

601. Atomic Energy of Canada, Ltd.—D.c. amplifier. 7th January, 1957. (807387.)

5761. Telefonaktiebolaget L. M. Ericsson.—Telephone instruments of the standing hand set type. 20th February, 1957. (807389.)

5799. Allis-Chalmers Manufacturing Co.—Insulation for electrical conductors and method of preparing same. 20th February, 1957. (807296.)

6044. Standard Telephones & Cables, Ltd.—Manufacture of semi-conductor devices. 22nd February, 1957. (807297.)

6123. Compagnie Générale de Télégraphie sans Fil.—Ceramic compositions for high power capacitors. 22nd February, 1957. (807259.)

8812. Philips Electrical Industries, Ltd. (Philips Gloeilampenfabrieken N.V.).—Electric discharge tubes. 18th March, 1957. (807390.)

9513. Standard Telephones & Cables, Ltd.—Single channel carrier frequency telephone communication system. 22nd March, 1957. (807391.)

23416. Westinghouse Electric International Co.—Aluminium iron magnetic sheets. 24th July, 1957. (807498.)

26140. Siemens & Halske A.G.—Arrangements for electromagnetically controlling contacts. 19th August, 1957. (807398.)

1958

32732. Fenn, L. E.—Electric cigarette lighters and heating elements therefor. 21st April, 1955. (Divided out of 807440.) (Addition to 772671.) (807441.)

Factory Equipment Exhibition

Lord Mills, Minister of Power, will open the 1959 Factory Equipment Exhibition, to be held at Earls Court, London, from 7th to 17th April. Equipment to be shown at this year's exhibition will cover a wide field of industry and will include heating and steam-raising plant; electrical, gas and oil equipment; ventilation, dust extraction and air-conditioning systems. Clean air will be the subject of a two-day conference to be held during the exhibition period. A self-contained heat and sound insulation exhibition will be a principal feature of the general exhibition. Here visitors will see a wide range of thermal and acoustic insulating materials for factories, methods of installation and special equipment for insulating such plant as steampipes and boilers. Two conferences, concerned with thermal insulation and noise in industry, will be held in connection with the insulation exhibition.

NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged.

MONDAY, 19th JANUARY

Birmingham.—Grand Hotel. Birmingham Electric Club. "Safety in the Use of Electricity, Part 2," by S. J. Emerson.

Bristol.—At Gardiner, Sons & Co., Ltd., Broad Plain, 7 p.m. I.E.S. Bath and Bristol Centre. "Open Space Lighting," by M. W. Pierce and H. F. Stephenson.

Cardiff.—At the South Wales Institute of Engineers, Park Place, 6 p.m. I.E.E. Western Supply Group. "The Future Pattern of Nuclear Electric Power Stations," by I. Everson.

Ipswich.—Electric House, 7.15 p.m. Ipswich and District Electrical Association. President's address, by H. C. Waters.

London.—Savoy Place, 5.30 p.m. I.E.E. Radio and Telecommunication Section. "High-Current Density Thermionic Emitters," by A. H. W. Beck.

Northampton College of Advanced Technology, St. John Street, E.C.1, 6.15 p.m. Institute of Metal Finishing, London Branch. "Printed Circuits—Some Metal Finishing Methods used on Foil-Clad Laminates in Electronic Production," by R. Eisler.

At the Institution of Mechanical Engineers, Birdcage Walk, Westminster. Incorporated Plant Engineers. "The Trans-Antarctic Expedition," by D. L. Pratt.

Newcastle-upon-Tyne.—Rutherford College of Technology, Northumberland Road, 6.15 p.m. I.E.E. North Eastern Radio and Measurement Group. "Power-System Automatic Frequency Control Techniques," by F. Moran.

Rutherford College of Technology, 7 p.m. Institution of Production Engineers, Northern Region. "Electronic Computers and the Production Engineer," by P. V. Ellis.

MONDAY, 19th JANUARY to THURSDAY, 22nd JANUARY

London.—Old and New Horticultural Halls. Physical Society Exhibition.

TUESDAY, 20th JANUARY

Aldershot.—Red Cross Hall, High Street, 8.45 p.m. A.S.E.E. Aldershot and District Branch. Film show.

Arborfield.—Assembly Hall, 3 (Tels.) Training Bn., R.E.M.E., 7 p.m. I.E.E. London Graduate and Student Section. District meeting. Film evening.

Edinburgh.—Carlton Hotel, North Bridge, 7 p.m. I.E.E. South East Scotland Sub-Centre. "Results of Full-Scale Stability Tests on the British 132 kV Grid System," by F. Busemann and W. Casson.

Leeds.—C.E.G.B. Offices, 1, Whitehall Road, 6.30 p.m. I.E.E. North Midland Utilisation Group. Informal discussion on "Trends and Future Requirements Affecting the Wiring and Testing of, and Supply to, Domestic Installation," opened by M. E. Broadbent.

Liverpool.—Merseyside and North Wales Electricity Board Industrial Development Centre, 6 p.m. I.E.S. Liverpool Centre. "New Light Sources," by F. Jackson.

London.—Savoy Place, 5.30 p.m. I.E.E. Measurement and Control Section. Discussion on "D.C. Amplifiers," opened by K. Kandiah.

Manchester.—Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North Western Measurement and Control Group. "The Atomic Clock," by Dr. L. Essen.

Oxford.—Employment Exchange, 7.30 p.m. A.S.E.E. Oxford and District Branch. "The Factory Acts," by S. J. Emerson.

WEDNESDAY, 21st JANUARY

Birmingham. — Engineering Centre, Stephenson Place, 10 a.m. Combustion Engineering Association, Midland Region. "Should the Boiler Operator be a Trained Man?" by C. A. J. Plummer, G. W. Hipkiss and N. Marshall.

Bournemouth.—Grand Hotel, 6.30 p.m. I.E.E. Southern Centre. "Domestic High-Fidelity Reproduction," by J. Moir.

Glasgow.—39, Elmbank Crescent, 7 p.m. I.E.E. South West Scotland Sub-Centre. "Results of Full Scale Stability Tests on the British 132 kV Grid System," by Dr. F. Busemann and W. Casson.

London.—Savoy Place, 5.30 p.m. I.E.E. Radio and Telecommunication Section. "Dielectric Materials—Trends and Prospects," by C. G. Garton.

I.E.E. London Graduate and Student Section, 2 p.m. Visit to Standard Telephones & Cables, New Southgate.

A.S.E.E. South East London Branch, 6.30 p.m. Visit to G.P.O. Mount Pleasant Parcel Office.

John Adam Street, Adelphi, W.C.2, 2.30 p.m. Royal Society of Arts. "Technical Education: A Prognosis," by Lord Nathan.

Nottingham. — Mechanics' Institution, Trinity Square, 7.30 p.m. A.S.E.E. Nottingham Branch. "Miniature Circuit-Breakers in Modern Installations," by J. A. Robbins.

Oxford.—Southern Electricity Board, 37, George Street, 7 p.m. I.E.E. Oxford district meeting. "Development of Off-Peak Heating with particular reference to Floor Warming," by S. C. Dinenage.

Peterborough.—Conference Room, Peterscourt, 7.30 p.m. Institution of Production Engineers, North Midlands Region. "Some Impressions of Modern Russia," by T. W. Wilcox.

Preston.—North Western Electricity Board, 19, Friargate, 7 p.m. I.E.S. North Lancashire Group. "An Architect's Approach to Lighting," by G. G. Baines.

Wolverhampton. — Wolverhampton and Staffordshire College of Technology, Wulfruna Street, 7.15 p.m. British Institution of Radio Engineers, West Midlands Section. "Learning Machines," by P. Huggins.

THURSDAY, 22nd JANUARY

Chelmsford.—Hoffmann's Social Hall, 7.30 p.m. Chelmsford Engineering Society. "Generation and Operation," by N. D. Norris.

Croydon.—Greyhound Hotel, High Street, 8 p.m. A.S.E.E. South London Branch. "Touch and Go" (film).

Hull.—Yorkshire Electricity Board Offices, Ferensway, 6.30 p.m. I.E.E. North Midland Centre. District meeting. Repeat of Chairman's address, by J. D. Nicholson.

Liverpool.—Exchange Hotel, 7.15 p.m. Incorporated Plant Engineers, Merseyside and North Wales Section. "Earthing Appliances," by J. A. Robbins.

London.—Savoy Place, 5.30 p.m. Institution of Electrical Engineers. "Subscriber Trunk Dialling," by D. A. Barron.

Middlesbrough.—Cleveland Scientific and Technical Institute, Corporation Road, 7.30 p.m. Society of Instrument Technology, Tees-Side Section. "Design Work in an Instrument Development Section," by T. W. Bain, and "Electronic and Electrical Development Work at Wilton," by L. English.

Sheffield.—Royal Victoria, 6.30 p.m. I.E.E. Sheffield Sub-Centre. Informal lecture by Sir Christopher Hinton.

FRIDAY, 23rd JANUARY

Coventry.—G.E.C. Ballroom, Copsewood. Coventry Electric Club. Annual ladies' night.

Didcot.—Marlborough Club, 7.30 p.m. A.S.E.E. Oxford and District Branch. "Relays and Automatic Control in Industry," by Dr. W. L. Stern.

Hanley.—Grand Hotel, 7.30 p.m. A.S.E.E. Stoke and Crewe Branch. "Electronics," by F. H. Fryer.

London.—At the I.E.E., Victoria Embankment. Radio Society of Great Britain. Presidential address.

London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1, 6.30 p.m. British Institution of Radio Engineers. Inaugural meeting of Medical Electronics Group. Address by Prof. A. V. Hill.

Luton.—Leicester Arms Hotel. A.S.E.E. Luton Branch. Ladies' night.

Manchester.—Engineers' Club, Albert Square. Institution of Heating and Ventilating Engineers, Manchester and District Branch. Annual dinner.

Moreton.—A.S.E.E. Liverpool and District Branch. Visit to Cadbury's factory.

TRADE MARK APPLICATIONS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 23rd January:—

Autosyn. No. 770,069. Class 9. Electrical apparatus for remote indication, remote measuring and for controlling the operation of contrivances by means of electric current, voltage, frequency or phase.—Bendix Aviation Corporation, New York, U.S.A. Address for service, c/o Frederick J. Cleveland, 303, Bank Chambers, 329, High Holborn, London, W.C.1.

Amp (design). No. 772,339. Class 9. Electric terminals, devices for use in effecting multiple connections in electrical wiring systems, capacitors, electrical pulse-forming networks and boards fitted with means for plugging-in and securing electrical contacts and conductors.—Amp, Inc., Harrisburg, Penn., U.S.A. Address for service, c/o Urquhart-Dykes & Lord, Maxwell House, 11, Arundel Street, Strand, London, W.C.2.

Trixomatic. No. 776,055. Class 9. Sound recording and reproducing apparatus and instruments; radio, telephonic, telegraphic and television apparatus and instruments, etc.—Trix Electrical Co., Ltd., 1-5, Maple Street, Tottenham Court Road, London, W.1.

Deccatrack. No. 780,093. Class 9. Scientific, electrical, electronic apparatus and instruments; and radio, radar, television, signalling, teaching and measuring apparatus and instruments, etc.—Decca Record Co., Ltd., 9, Albert Embankment, London, S.E.11.

Wan-Tel-Met-Hi. No. 780,791. **Wan-Tel.** No. 780,790. **Wan-Tel-Met-Stan.** No. 780,792. Class 9. Covered electric wire and electric cables.—Wandleside Cable Works, Ltd., 106, Garratt Lane, Wandsworth, London, S.W.18.

Philips. No. 780,766. Class 10. Electrically operated hearing aids for the deaf, and parts.—Philips Electrical, Ltd., Century House, Shaftesbury Avenue, London, W.C.2.

Paragrid-Tile. No. B775,219. Class 11. Louvered laylights made of tiles in the form of grids and being parts of electric lighting installations.—J. A. Wilson Lighting & Display, Ltd., Toronto, Canada. Address for service, c/o Norman S. Barlow, 395, Streetsbrook Road, Solihull, Warwickshire.

Telcomatic. No. 781,634. Class 11. Boilers (not parts of machines).—Telegraph Construction & Maintenance Co., Ltd., Mercury House, Theobalds Road, London, W.C.1.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Aberdare.—U.D.C. 24th April. Electric lamps (Form No. 14), for one year to 31st March, 1960. Engineer and surveyor, Vestry Hall.

Australia.—Electricity Commission of New South Wales, Sydney. 22nd January. Fourteen 33 kV/100 V transformers. (E.S.B. 32115/58. Ten/36598.)* Twenty 66 kV/110 V transformers. (E.S.B. 32116/58. Ten/36600.)* Fourteen 22 kV/110 V transformers. (E.S.B. 32114/58. Ten/36599.)* 2nd February. 3·3 kV, 250 MVA air break switchgear. (E.S.B. 32111/58. Ten/36576.)*

Brisbane City Council. 20th February. 33 kV underground cable, sealing ends and joints. (E.S.B. 31949/58. Ten/36577.)*

State Electricity Commission of Victoria, Melbourne. 29th April. Turbo-generator plant, generator transformers and switchgear. (E.S.B. 31871/58. Ten/36554.)*

Electricity Trust of South Australia, Adelaide. 3rd March. Turbo-alternator, condensing and feed-heating plant for Port Augusta "B" power station. (E.S.B. 31902/58. Ten/36672.)*

Postmaster-General's Department, Melbourne. 26th February. Start-stop telegraph machines. (E.S.B. 31939/58. Ten/36621.)*

Bebington.—Corporation. 7th February. Trunk road lighting equipment. (See this issue.)

Beckenham.—Borough Council. 26th January. Electric lamps for the year from 1st April. Borough engineer, Town Hall.

Bedlingtonshire.—U.D.C. 14th February. Electrical accessories and electric cookers and boilers for the year ending 31st March, 1960. A. K. Dennis, surveyor, Council Offices, Bedlington.

Belfast.—King George VI Youth Council. 23rd January. Electrical installation in Youth Centre. Barrett & Agnew, 420, Ravenhill Road, Belfast.

Burma.—Burma Purchase Board. 26th January. Electric cable. (E.S.B. 32237/58. Ten/36627.)*

Ceylon.—Department of Government Electrical Undertakings, Kolonnawa. 21st January. Transformers. (E.S.B. 32191/58. Ten/36597.)*

Consett.—U.D.C. 14th February. Electric lamps for street lighting for one year to 31st March, 1960. Surveyor's Department, Council Offices, Medomsley Road.

Formosa.—Central Trust of China, Taipei. 30th January. 5,000 V cable, two 100 h.p. electric motors, two magnetic starters and spare parts, three 75 kVA and one 50 kVA transformers and spare parts. (E.S.B. 3209/58/I.C.A. Ten/36677.)*

Great Yarmouth. — Corporation. 30th January. Electric cables for one year. (See this issue.)

Huddersfield.—Borough Council. 28th January. Electric lamps (Schedule 17), electric lamps—mercury vapour and sodium (18), and electric cables (19), for the year ending 31st March, 1960. Borough engineer, High Street Buildings.

India.—Damodar Valley Corporation, Calcutta. 28th January. Ventilating system equipment for Panchet Hill power station. (E.S.B. 32219/58. Ten/36629.)*

King's Lynn.—Borough Council. 2nd February. Electric lamps and electrical sundries for the year ending 31st March, 1960. H. G. Ridler, borough engineer, 17, Queen Street.

Kintullagh, Ballymena (Co. Antrim).—11th February. Electrical installation in new primary school. C. P. McNally, 143, Royal Avenue, Belfast.

New Zealand.—N.Z. Electricity Department, Wellington. 24th March. Four 10,000 kVA transformer units. (E.S.B. 32106/58. Ten/36575.)*

Pakistan.—Posts and Telegraphs Department, Karachi. 21st January. Protectors and heat coils for telephone lines. (E.S.B. 31970/58. Ten/36602.)* 2nd February. Telegraph cable. (E.S.B. 432/59. Ten/36663.)*

Salvador.—Comisión Ejecutiva Hidroeléctrica del Río Lempa El Salvador. One 16,667 kVA generator. (E.S.B. 32004/58. Ten/36584.)*

Stockport.—Corporation. 31st January. Street lighting equipment, electric lamps, lanterns, chokes, capacitors and electric time switches for one year from 1st April. Borough surveyor, Town Hall.

Twickenham.—Borough Council. 26th January. Street lighting columns, street lighting fittings, electric cables, conduit, lamps, etc., for one year from 1st April. Borough surveyor, Municipal Offices.

United States.—U.S. Army Engineer District, Walla Walla, Corps of Engineers, Washington. 27th January. Three 94,737 kVA generators and appurtenances. (E.S.B. 32150/58. Ten/36615.)*

Watford.—Borough Council. 10th February. Electric lamps and tubes for the year ending 31st March, 1960. Borough engineer, Town Hall.

Winchester.—City Council. 26th January. Electric lamps for one year to 31st March, 1960. City Engineer's Department, Guildhall.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Adwick-le-Street. — Houses, Woodlands (58) and Carcroft estate (78), and 12 flats in Charles Street, Carcroft; W. Ellis, surveyor, Urban Council Offices, Adwick-le-Street, Yorks.

Brierfield.—Library; Lancs. county architect, County Offices, Preston.

Chichester.—College of Further Education, Westgate Fields; West Sussex county architect, County Hall, Chichester.

Congleton.—Works, Townsend Lane; Royle Knitting Mills, Ltd., Mill Street.

Darlington.—New police station and courts; county architect, South Street, Durham.

Factory additions (10,000 sq ft) for Underground Mining Machinery Co., Ltd.; G. Stephenson, builders, Chester Street, Bishop Auckland.

Durham.—Branch library, Ferryhill; county architect, South Street, Durham.

Edinburgh.—Houses (308), Clermiston South, new central swimming pool, and four new swimming baths in suburbs; A. Steele, city architect, City Chambers, High Street.

Liverpool.—Second phase of Greaves Hall Mental Deficiency Colony, main Southport to Preston Road (£1,000,000), for Regional Hospital Board; T. Noel Mitchell, regional architect, 55, Castle Street, Liverpool, 2.

London.—Church and community centre, Purbrook Street, Bermondsey; Covell & Matthews, architects, 34, Sackville Street, W.1.

School of Physiotherapy, General Hospital, Paddington; North West Metropolitan Regional Hospital Board, 40, Eastbourne Terrace, W.2.

Flats and maisonnettes (58), and library, Allfarthing Lane, Wandsworth; H. Bailey, architect, 47, Whitehall, London, S.W.1.

Madeley.—Village hall; Hollins, Jones & Oldacre, architects, Bank Chambers, Newcastle, Staffs.

Middlesbrough.—Library and offices in Newport Road; borough engineer.

Mitcham.—Hostel, Tamworth Lane; Fredk. Barber & Partners, architects, 5, Apple Market, Kingston-on-Thames.

Newcastle-on-Tyne.—Five-storey students' hostel at Cochrane Park (£400,000), for Council of King's College.

Flats (246), Newbiggin Hall estate, for the City Council; Cussins, Ltd., contractors, The Drive, Gosforth.

New Romney.—Housing estate, Langport Road; William Ryder, architect, 68, Jermyn Street, London, S.W.1.

Northumberland.—Remodelling of Hazlerigg County Primary School (£38,000); county architect, County Hall, Newcastle-on-Tyne.

Nottinghamshire.—Extensions to Hawtonville County Junior School (£34,250), and Newark County Technical College (£20,140); county architect, County Offices, Trent Bridge, Nottingham.

Prudhoe (Northumberland).—Houses (89), Wylam, for U.D.C.; Wimpey & Co., Ltd., contractors, Fenwick Terrace, Newcastle-on-Tyne.

Further additions to Prudhoe and Monkton Hospital for Newcastle Hospital Board, Benfield Road, Newcastle; Board's chief architect.

Purfleet.—Offices for Esso Petroleum Co., Ltd.; J. L. Eve Construction Co., Ltd., 17, Hillside, London, S.W.19.

Reading.—Houses (40), Mulfords Hill, Tadley; Blakes, Ltd., Bath Road, Woolhampton.

Rugby.—Houses and bungalows (168), Featherbed estate; T. Wilson & Son, Ltd., 65, Sheep Street, Northampton.

Proposed new town hall and municipal offices; borough surveyor.

Sedgefield.—Reconstruction of nurses' home at Winterton Hospital for Newcastle Hospital Board, Benfield Road, Newcastle-on-Tyne; P. H. Knighton, chief architect.

Sheffield.—Cinema, Bank Street and Angel Street; Associated British Cinemas, Ltd., 30, Golden Square, W.1.

Showrooms and offices, The Moor; James Miller & Partners, Ltd., New Millerdam, Wakefield.

Swadlincote.—Library, central area; Wm. Blair, architect, Burton House, Burton Road, Derby.

Tynemouth.—Branch library at Billy Mill; borough engineer, 16, Northumberland Square, North Shields.

West Hartlepool.—Community centre and library, Owton Manor estate; A. G. Sinclair, borough architect.

Wick.—New public hall and community centre (£65,000); burgh surveyor, Wick, Caithness.

Wincanton.—Thirteen old people's dwellings and warden's and community block at Balsam Fields; A. R. Hill, surveyor, Rural Council Offices.

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* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).